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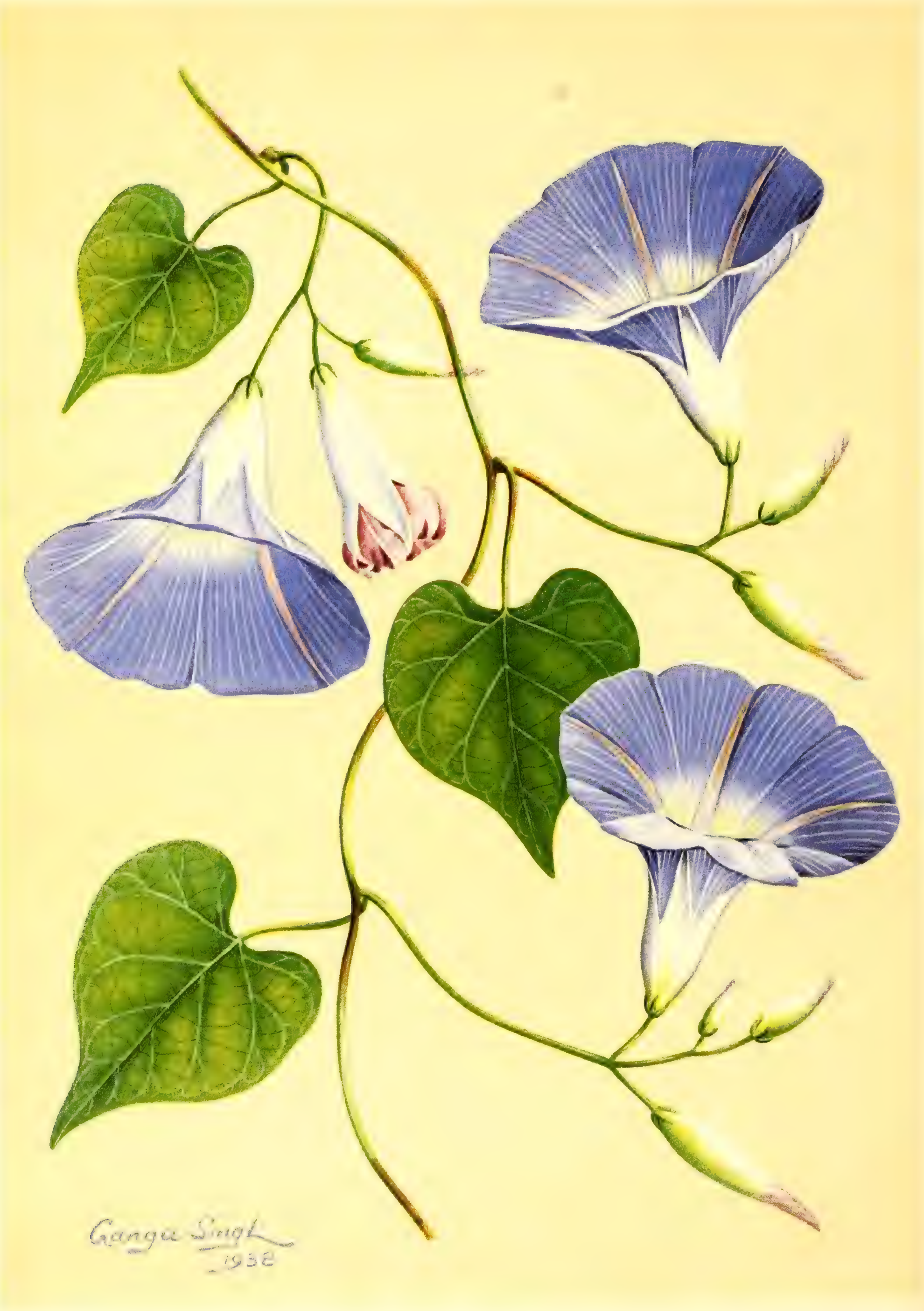
Ganga Singh
1938

John Bale, Sons & Curnow, Ltd London.

Heavenly Blue Morning Glory.
Ipomoea rubro-caerulea, Hook.
(⅝ nat. size)

JOURNAL
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SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

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Forest Botanist,

AND

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Assistant Botanist,

Forest Research Institute, Dehra Dun.

(*With one coloured and two black and white plates and ten text-figures.*)

INTRODUCTION.

This series will deal with some of the commoner climbers and shrubs which are to be found in our Indian gardens.

It must not be assumed from the title of the series that all of the plants described are natives of India.

This is not so, for the very great majority of them have been introduced from other tropical countries, but are now so common in our gardens that they may be considered to be naturalised. Many of them even have escaped from gardens and are found growing wild.

The plates have been reproduced from paintings of the living plant executed by Ganga Singh, Artist, Botanical Branch of the Forest Research Institute. Mr. C. E. C. Fischer, I.F.S. (Retd.), Assistant for India at Kew, has been kind enough to help us with nomenclatural problems.

Ipomoea Linn.

The genus **Ipomoea,** which is the largest in the family *Convolvulaceae*, is native in most of the tropical and sub-tropical regions of the world. Many of its four hundred species have been

MAR 1 1940

introduced into our Indian gardens where they are cultivated for their striking, and often very beautiful, flowers. The generic name seems to be derived from two Greek words : *Ips*, bindweed, and *homoios*, like, similar to.

The genus *Ipomoea* as known to Linnaeus, and to Hooker in the *Flora of British India*, has been the subject of much systematic work in recent years and has been greatly modified. Garden plants well known to horticulturists as species of *Ipomoea* now appear under such generic names as *Quamoclit, Mina, Calonyction, Merremia*, and so forth. Some of these genera are quite distinct and are gradually being accepted. On the other hand the nature of the extine of the pollen, whether echinulate or not, as a character for splitting genera, may appeal to a monographer, but is hardly likely to find favour with horticulturists. Hence, in this series of articles, the ordinary name as known to horticulturists will be given together with the correct name in brackets.

The majority of the species found in our gardens are herbaceous twiners; but one, which will be treated in this article, is a shrubby scrambler. The presence of latex vessels in the bark is not uncommon.

The flowers of *Ipomoea*, in the wide sense, may be salver-, bell-, or funnel-shaped. They are, as a rule, large and showy, with red, blue, yellow or purple corollas and are borne singly or in clusters in the axils of the alternate, often cordate, leaves.

The method of folding in the bud, a feature which is quite apparent in the fully opened flower, is characteristic of the genus. Five triangular, smooth and rigid areas arising and tapering from the base of the corolla are easily discernible. In the intermediate spaces are areas of more delicate texture which, in the bud, are folded inwards so that the triangular firmer areas are exterior, and touch by their edges. The bud is twisted to the right.

The calyx lobes are five in number and may be united or free, glabrous or hairy. The stamens, too, are five; and are alternate with the triangular bands referred to above. The ovary, which may be two-, three- or four-celled, is seated upon a fleshy disc which secretes nectar.

The flowers in most species are short-lived and only remain open for a short time; sometimes only a few hours. Others remain open all day, while a few open at sunset and wither at dawn. When withering the corolla rolls up and remains tightly closed till it falls.

Some species with tubular corollas are adapted to cross pollination by birds (e.g. *Ipomoea* (*Mina*) *lobata*) while others are fertilised by insects or by the wind. If cross fertilisation does not occur when the flower is open, self-fertilisation is almost certainly accomplished when the withering corolla rolls up.

Economic uses.—The sweet potato, *Ipomoea batatas* is grown extensively for its large, edible, fleshy-fibrous roots. *I. turpethum* furnishes a well-known purgative named Indian Jalap. The Jalap of the British Pharmacopoeia is the resin obtained from the roots of *I. purga*. *I. pes-caprae* has some repute as a sand binder.

It is, however, as a garden plant that the genus is most highly valued. Their gorgeous flowers and the ease with which they may be propagated have contributed to their popularity. Most species are not exacting as regards soil but they love a sunny site with plenty of water. To ensure early germination it is recommended that a small notch be filed in each seed or that they be soaked in warm water for about two hours. The perennial species can be grown from seed but they can also be propagated vegetatively by cuttings, layers or division of the roots. Owing to their thick foliage and rapid growth it is advisable to grow the climbing species over trellis-work.

KEY TO THE SPECIES.

- Climbing species.
  - Corolla salver-shaped.
    - Stamens and style far exserted from corolla: flowers orange or scarlet ... ... *I. lobata.*
    - Stamens and style not much exserted: flowers a brilliant crimson.
      - Leaves ovate-cordate ... ... *I. coccinea.*
      - Leaves with filiform segments ... ... *I. Quamoclit.*
  - Corolla campanulate.
    - Leaves deeply lobed or palmately compound:
      - Sepals hairy: corolla yellow ... ... *I. vitifolia.*
      - Sepals glabrous.
        - Lobes of leaf again lobed or deeply serrate, flowers white with a purple eye: ... ... *I. sinuata.*
        - Lobes of the leaf elliptic.
          - Sepals purplish: flowers shining rose or light purple ... ... *I. Horsfalliae.*
          - Sepals greenish: flowers violet-purple with a purple tube ... ... *I. palmata.*
    - Leaves entire:
      - Sepals short and thick ... ... *I. rubro-caerulea.*
      - Sepals prominently acute.
        - Sepals acute ... ... *I. purpurea.*
        - Sepals long acuminate ... ... *I. Learii.*
- Scrambling shrub; flowers pink ... ... *I. carnea.*

Ipomoea rubro-caerulea Hook. (**I. tricolor** Cav.).

Morning-glory; Heavenly Blue.

(*rubrocaerulea* is derived from two Latin words meaning red and sky blue, and refers to the colour of the corolla which fades from blue to red.)

Description.—A twining, glabrous creeper of extensive growth, requiring a large trellis for its support. Branches rounded, herbaceous, tinged with purple. Leaves alternate, membranous, dark green, truly cordate, with a deep and broad sinus at the base, shortly but sharply acuminate, quite entire, wavy on the surface, much veined.

Peduncles axillary, hollow, longer than the petioles, 3- to 4-flowered, the pedicels thickened. Calyx five-partite, the segments small, erect and appressed, linear-subulate; corolla funnel-shaped, white in the bud but tinted with a rich red which, when the flower is fully expanded, becomes clear azure blue or purple, with five angles and five plicae; the angles mucronate. Stamens 5; filaments unequal, inserted at the base of the tube, hairy at the base. Anthers oblong, yellow (sometimes tinged with purple). Ovary superior, oblong, 2-celled, with 2 ovules in each cell. Style filiform, stigma 2-lobed. Fruit a capsule, usually 4-valved containing 4 seeds.

Flowers.—September-November. *Fruits.*—Cold season.

Native country.—This plant is a native of Mexico, but is now extensively cultivated in all tropical countries of the world.

Though a perennial it becomes exhausted after one season and therefore, can be only cultivated successfully as an annual. It blossoms at the beginning of the cold season, opening its large clear blue flowers in countless numbers early in the morning and presenting then as gorgeous a sight as anyone could possibly wish for. The flowers fade in the after part of the day, turning first to a reddish or purplish tinge.

Gardening.—It is essential that the seed be sown as early as July in order that the plants may grow to perfection by the beginning of the cold weather; they do not require a rich soil, but a change of locality each year is desirable. Its rapid growth and dense foliage make it specially valuable for quick covering of arbors, verandahs, walls, and for screening unsightly objects. It is also valuable for cut flowers.

Ipomoea rubro-caerulea Hook. var. *alba* Hort.; a variety with white flowers but not nearly so beautiful.

Ipomoea Quamoclit Linn. (**Quamoclit pinnata** Bojer)

'The Cypress-Vine or Indian Pink'.

Description.—A beautiful annual twiner. Stem smooth, slender, twining to a height of about 20 ft. Leaves short-petioled or sessile, pinnately divided into many filiform segments. Peduncles few-flowered, commonly much longer than the petioles. Corolla 1-1.5 in. long, scarlet, the tube narrowly salver-shaped, inflated above; the limb nearly flat, 5-lobed. Stamens exserted.

Flowers.—Rainy season. *Fruits.*—October-December.

Distribution.—It is a native of tropical America and is now widely spread in the warmer parts of the world.

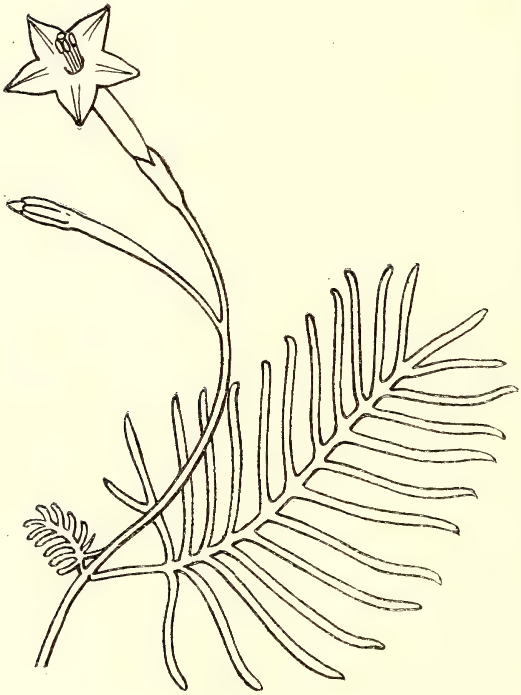

Fig. 1.—*Ipomoea Quamoclit* Linn. × $\frac{1}{1}$

Gardening.—Raised from seed usually sown in early spring. It is a very elegant species and makes rapid growth from June, and covers a trellis very rapidly.

Ipomoea Quamoclit L. var. *alba* Hort. has white flowers, but is seldom seen in cultivation in this country.

Medicinal uses.—The Hindus consider it to have cooling properties. The pounded leaves are applied for haemorrhoids, while a preparation of the juice with hot 'ghee' is administered internally. In Bombay, the leaves are used as a 'lep' (plaster) for carbuncles.

Ipomoea Horsfalliae Roth.

(Dedicated to Mrs. Charles Horsfall, at whose home it was first raised in England.)

Description.—A more or less woody, perennial, tall, glabrous twiner. Leaves more or less circular or orbicular-ovate in outline, palmate, with 5, or rarely 7, leaflets which are obovate, oblanceolate or elliptic, 3-4 in. long, acuminate, entire, rather thick in texture, margin slightly crisped or waved. Peduncles axillary, about as long as, or longer than, the petioles, bearing a forked cyme of many flowers; pedicels thickened upwards, smooth. Calyx of 5 equal, rather broad, purplish-black, imbricated lobes. Corolla narrowly funnel-shaped 2-2.5 in. long, the limb with prominent plaits and becoming revolute, of a deep rich and glossy rose, equally dark within and without. Stamens 5, shortly exserted. Ovary globose, surrounded by a large fleshy ring. Stigma capitate, two-lobed, hairy.

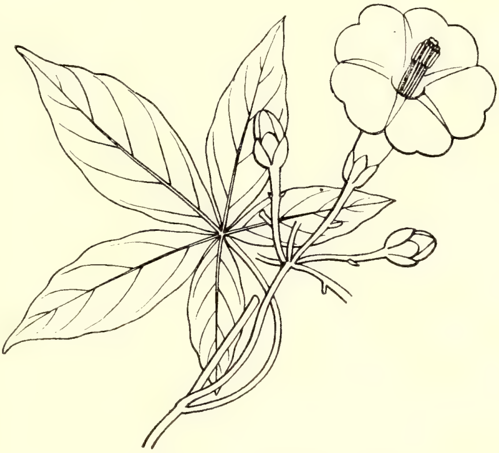
Fig. 2.—*Ipomoea Horsfalliae* Roth. ×½

Flowers.—September-December. The plant does not appear to set seed in India.

Distribution.—Native of the hotter parts of America and perhaps of the Old World; now commonly cultivated in all tropical parts of the earth.

Gardening.—As this species rarely produces viable seeds it is usually propagated from root cuttings which strike with great difficulty. It is very suitable for pergolas in the open.

Ipomoea Horsfalliae Roth. var. *Briggsi* Hort., is a free flowering plant with magenta-crimson flowers.

Ipomoea Learii Pax.

Blue Dawn-flower.

(Named in honour of Mr. Lear, who is chiefly known as a collector of Ceylon plants. The seeds from which plants were first raised in England were received from him. The plant, however, is not a native of Ceylon but of tropical S. America.)

Description.—A perennial climber, somewhat woody at the base; the stems finely pubescent. Leaves 3-5 in. long and as broad, mostly entire or sometimes deeply 3-5-lobed, pubescent on both surfaces, base cordate, apex acute; petiole slender, nearly as long as the blade. Flowers in capitate clusters of 5 to many flowers, 3-4 in. long and as much across, bright violet-blue when fresh, with 5 narrow, pinkish bands. Sepals about .7 in. long, linear-lanceolate, hairy pubescent. Corolla very beautiful, campanulate, suddenly widened at the mouth.

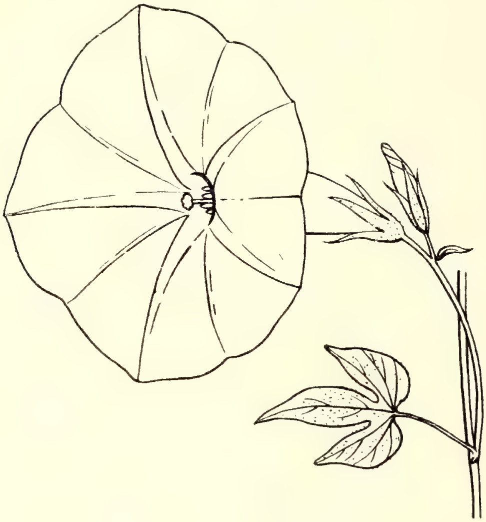

Fig. 3.—*Ipomoea Learii* Pax. × ½

Flowers.—August-October. Seeds ripen in October-December.

Distribution.—Indigenous to S. America, but now widely cultivated in the tropics of both hemispheres.

Gardening.—It is propagated by seed sown at the break of the rains. It is a magnificent species and a most useful plant for covering waste places, embankments and the like. It is not usually grown on a trellis.

Ipomoea palmata Forsk. (**I cairica** Sweet.)

The Railway Creeper.

(*palmata* is Latin for shaped like a hand.)

Description.—A perennial climbing shrub. Stem glabrous and more or less warty. Leaves 1-3 in. in diameter, cut nearly to the base into 5-7 elliptic or lanceolate entire lobes. Flowers 2-3 in. across, purple, in axillary, often 3-flowered cymes. Sepals .25 in. long, broadly ovate. Corolla campanulate, mauve or purple with a deeper tinge in the throat. Fruit a capsule

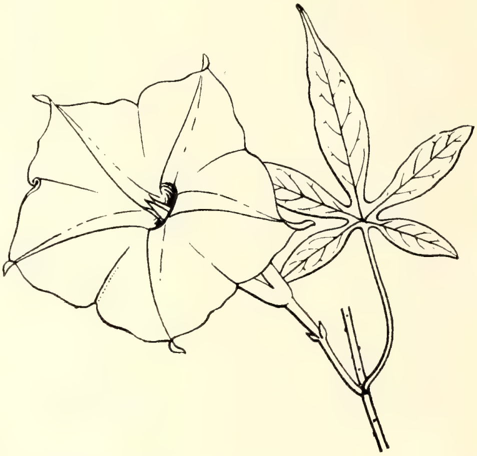

Fig. 4.—*Ipomoea palmata* Forsk. × ½

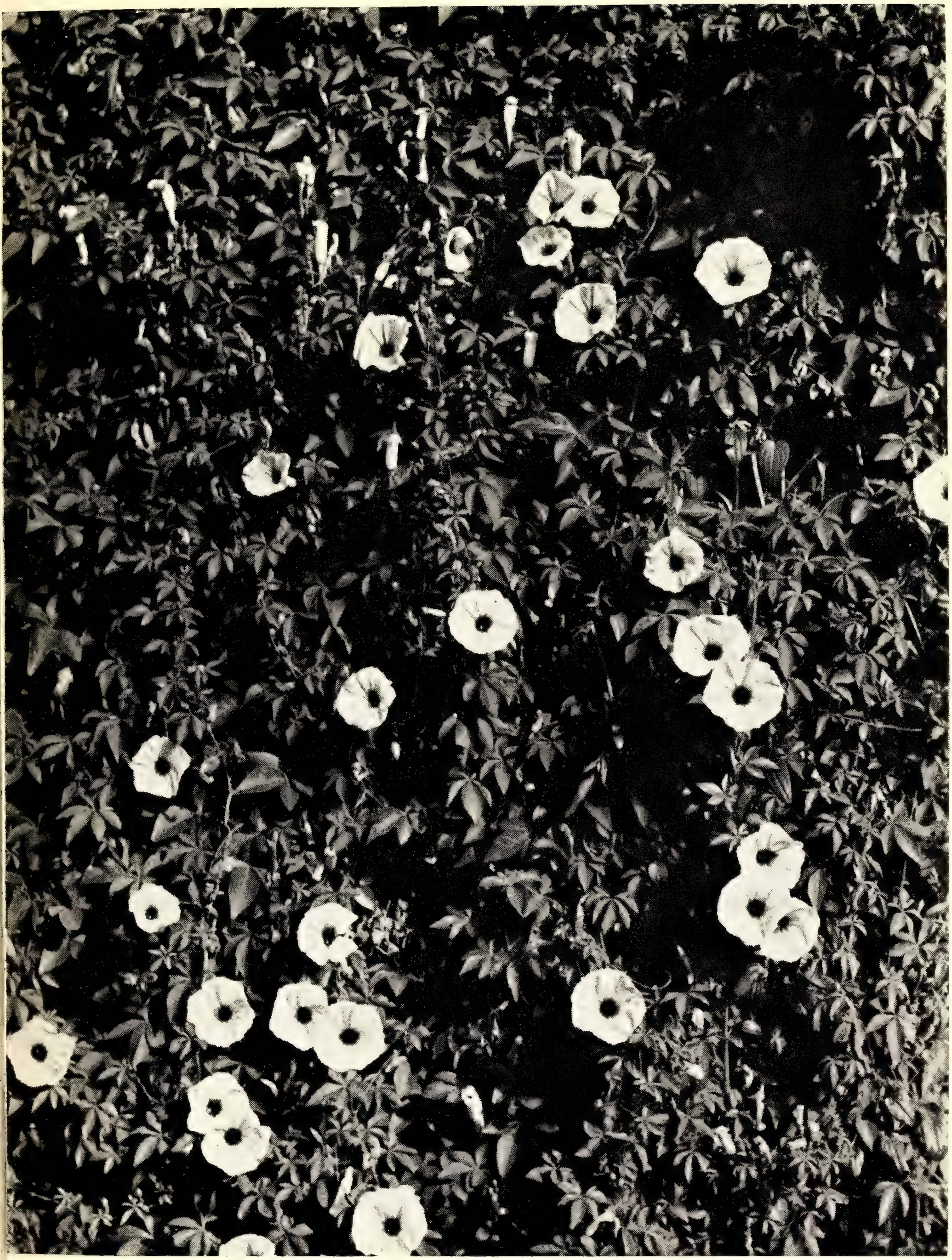

Photo by M. M. N. Bakshi.

Ipomœa palmata Forsk.
Botanical Garden, Forest Research Institute.

.5 in. long, ovoid, glabrous; seeds pubescent with woolly margins.

Flowers and fruits.—Practically all the year round.

Distribution.—Indigenous or naturalized in most tropical countries.

Gardening.—Easily grown from cuttings of the branches. The small tubercles on half mature stems, on coming in contact with soil easily strike root. It is exceedingly common on trellises in gardens and fences on railway platforms (hence the name Railway Creeper).

Ipomoea carnea Jacq.

(*carneus* means flesh-coloured and refers to the colour of the corolla.)

Description.—A stout, straggly shrub with milky juice, suberect, at times climbing to about 30 ft. Leaves about 4 in. long, 2 in. broad, ovate or ovate-lanceolate, long acuminate, base cordate, entire, soft and somewhat fleshy; petiole 2.5 in. long. Flowers large, rose or light mauve, 2.5 in. long, 2 in. across, in axillary cymes. Peduncles 2-4 in. long. Sepals .2 in. long, broadly ovate. Corolla campanulate, narrowly cylindrical for about .2 in. at the base, suddenly widened at the top. Fruit a capsule, .5 in. long, glabrous. Seeds silky.

Flowers.—All the year except the coldest months. *Fruits* in November-December in N. India.

Distribution.—Indigenous to S. America, but now commonly cultivated in the plains especially at Railway stations.

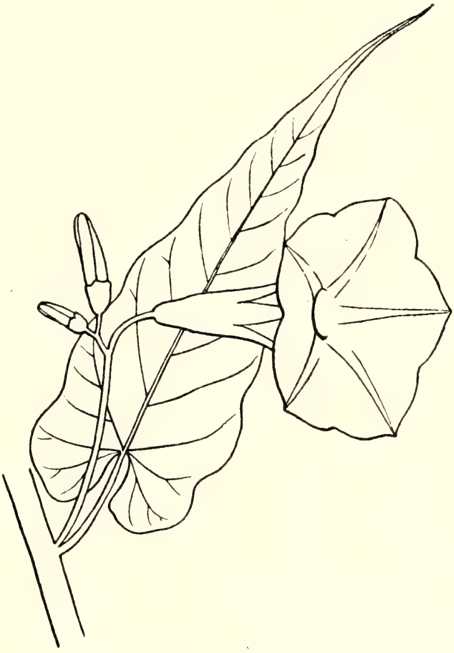

Fig. 5.—*Ipomoea carnea* Jacq. ×½

Gardening.—It is easily grown from cuttings and is inexacting as regards site and soil.

Ipomoea vitifolia Sweet.

(The specific name refers to the leaves shaped like those of a vine.)

Description.—An extensive, perennial, nearly evergreen twiner, hairy all over. Leaves hairy, suborbicular or broadly ovate in outline, cut one-third to one-half the way down into ovate or triangular, acute or acuminate lobes which are often strongly toothed, palmately-nerved with 5-7 basal nerves; petiole .5-4 in. long. Flowers sulphur-coloured, very pretty, in peduncled, hairy cymes of one to seven blooms. Sepals .5 in. long, hirsute, hardened; .7-.9 in. in fruit. Corolla 2-2.5 in. in diameter. Fruit a capsule, .5 in. in diameter, irregularly breaking up, semi-transparent, usually 4-seeded. Seeds black or slate-coloured with a matt surface.

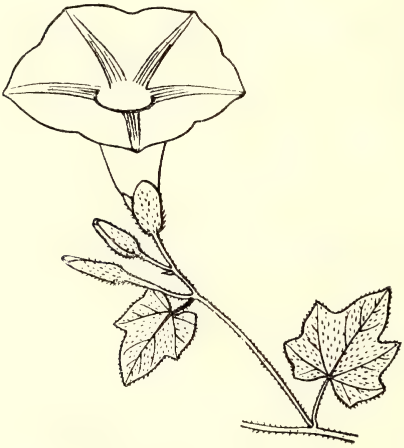

Fig. 6.—*Ipomoea vitifolia* Sweet. × ½

Flowers.—October-March. *Fruits.*—May-June.

Distribution.—Throughout India (except the North-west), Malaya Islands.

Gardening.—It is usually propagated by stem cuttings or layers. It is a very fast grower and suitable for covering walls, trellises and pergolas.

Medicinal uses.—An infusion of the leaves is supposed to be cooling and is applied for inflammation of the eyes.

Ipomoea coccinea L. (**Quamoclit coccinea** Moench).

The Star Ipomoea.

(*coccineus* means crimson and refers to the flowers.)

Description.—An annual, weak, glabrous twiner, climbing to about 15 ft. Leaves ovate-cordate, slender, petioled, 2-4 in. in diameter, entire or angulate, acuminate, petiole 2-4 in. long. Flowers in few- to many-flowered lax cymes. Peduncle 2-6 in. long, slender. Bracts inconspicuous. Sepals .4 in. long, unaltered in fruit. Corolla crimson, in garden varieties often orange or yellow; tube 1 in. long, mouth .9 in. in diameter, limb obscurely lobed. Ovary completely 4-celled, 4-ovuled. Fruit a capsule .4 in. long or rather more, ovoid, smooth. Seeds furred.

Flowers.—Rainy season. *Fruits.*—October-November.

Distribution.—Probably indigenous to N. Mexico and Arizona, but now common throughout India, cultivated or semi wild.

Gardening.—Easily raised from seed sown early in the rains. The scarlet flowers, though rather small, are produced in profusion.

Ipomoea coccinea L. var. *hederifolia* House. This form of the species has angulate, 3-lobed or even 3-5-parted, lobed leaves and

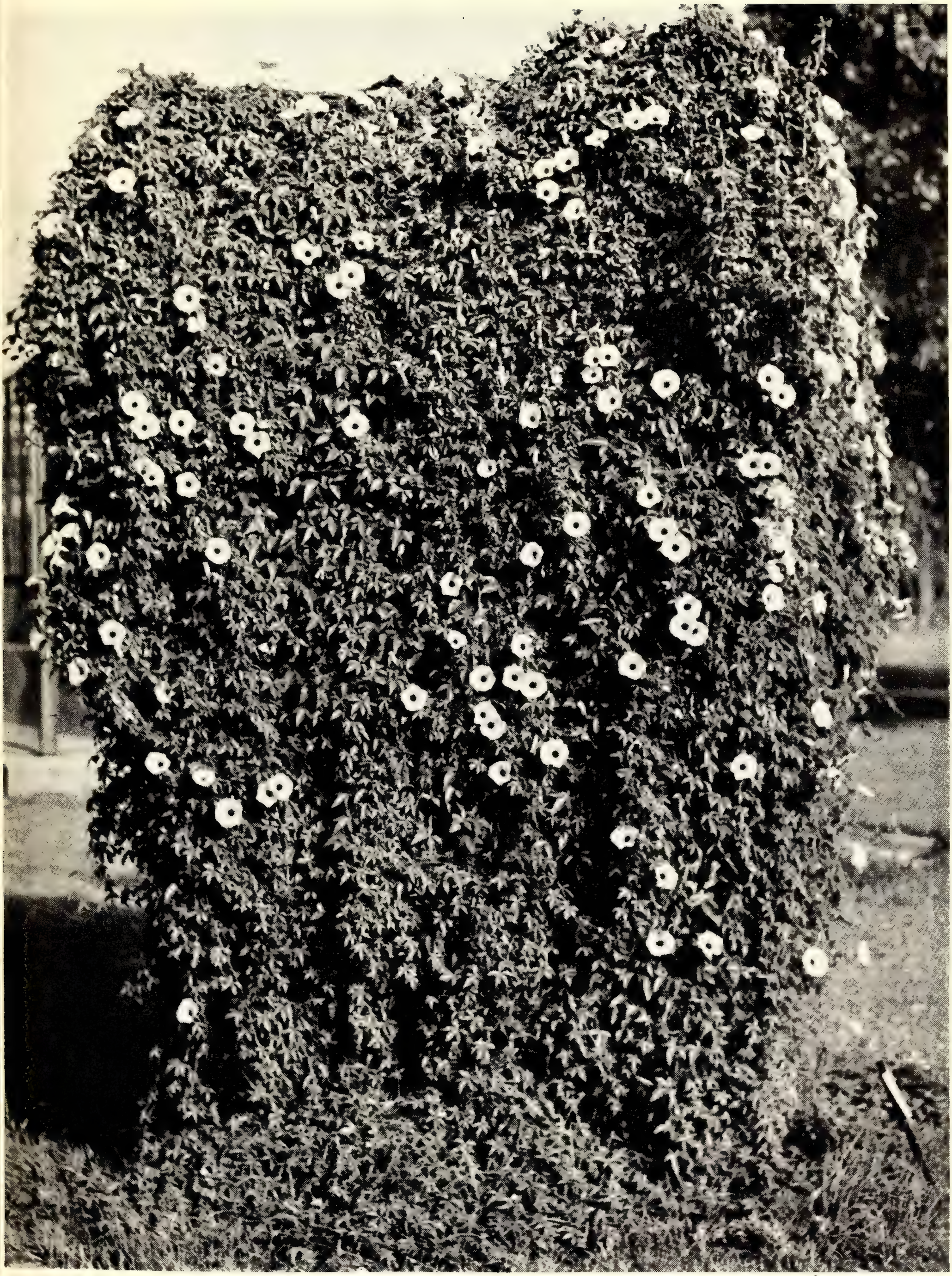

Photo by M. M. N. Bakshi.

Ipomœa palmata Forsk.
Botanical Garden, Forest Research Institute.

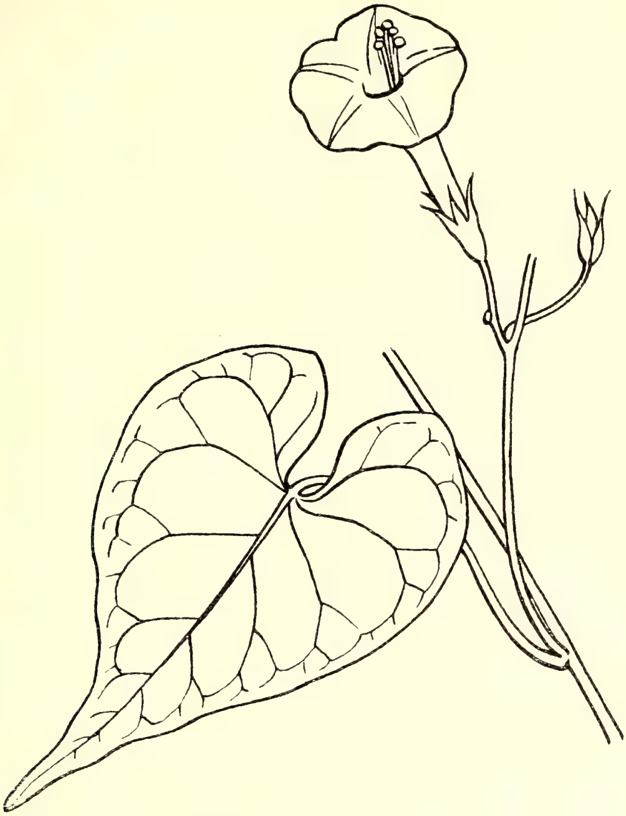

Fig. 7.—*Ipomoea coccinea* Linn. ×$\frac{1}{1}$

usually large flowers. It is superior to the type for ornamental purposes. Rarely seen in cultivation in this country.

Medicinal uses.—The root is sternutatory.

Ipomoea lobata Thell. (**Quamoclit lobata** House, **Mina lobata** Llav. and Lex.).

(*lobata* refers to the lobed leaves.)

Description.—An annual vigorous and quick growing creeper not attaining a very great length. Leaves cordate, with a broad sinus, 3-lobed, the middle lobe longest and narrowed below. Inflorescence a spiral cyme; peduncles stout below, several-flowered. Flowers .5-.9 in. wide, when open rich crimson or orange, soon fading to pale yellow. Sepals tipped with short awn-like points. Corolla salver-shaped, stout and tubular below, abruptly widening into a cylindric or bag-shaped limb with 5 small, acute lobes. Stamens long exserted. Fruit with false partitions between the seeds.

Flowers.—September-December (occasionally in January). *Fruits.*—November-January.

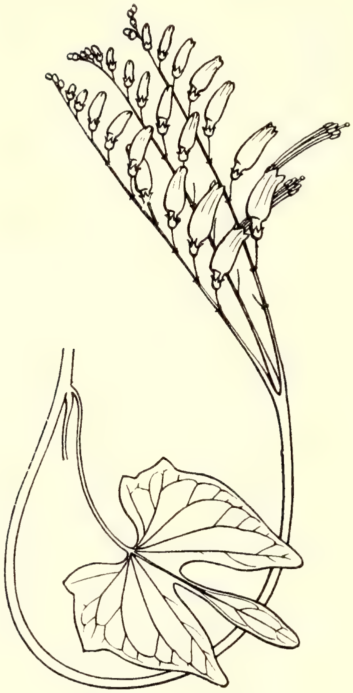

Fig. 8.—*Ipomoea lobata* Thell. ×½

Distribution.—A native of Mexico, but now commonly cultivated in all tropical countries.

Gardening.—Propagated by seeds sown in early June either in the ground or in pots. It is best suited for growing on small arches and on posts. It is a free-flowering climber and deservedly popular.

Ipomoea purpurea Lamk.

The Common Morning Glory.

(*purpurea* refers to the colour of the flowers).

Description.—An annual, hairy climber with entire, ovate-cordate, shortly acuminate, pubescent, 3-5 in. long, leaves. Flowers 1-5 on axillary peduncles, funnel-shaped, 2-3 in. long, varying in colour from white to pale-blue or purple. Calyx-lobes less than half the length of the tube, acute but not elongated and somewhat exceeding the capsule in fruit.

It resembles *I. hederacea* (another garden species) at first sight but can always be distinguished from it by its smaller and entire leaves and by the sepals not having ligulate tips.

Flowers.—During the rains. *Fruits.*—October-November.

Distribution.—It is said to be a native of tropical America but is certainly found wild in India. It is extensively cultivated in all warm countries.

Gardening.—Easily raised from seed sown in April. One of the most popular of garden annuals. It is found in many races in cultivation,

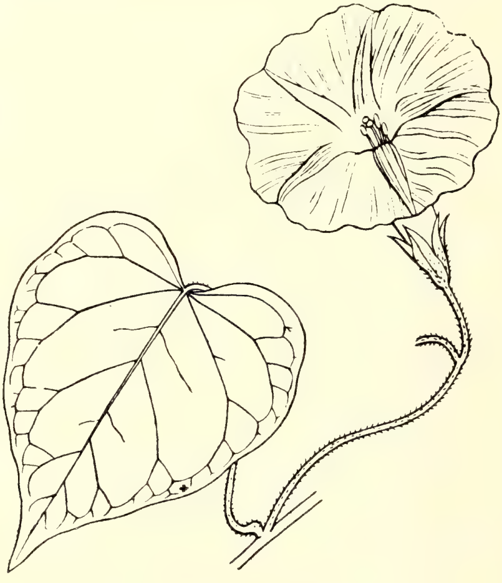

Fig. 9.—*Ipomoea purpurea* Lamk. ×½

varying in colour of the flowers, with variegated foliage, and sometimes with double flowers.

Ipomoea sinuata Ortega.

(*sinuata* refers to the margins of the lobes of the leaf.)

Description.—A perennial, extensive, twining shrub covered with long, yellowish hairs. Leaves 2-4 in. in diameter, smooth, sinuately cut nearly to the base into about 7 lanceolate, pinnatifid segments which are toothed. Peduncles 1-2-flowered, longer than the petioles. Flowers about 1 in. across, white, with purple centres. Sepals ·8 in. long, glabrous, elliptic-oblong. Corolla bell-shaped. Fruit a capsule .5 in. in diameter, glabrous.

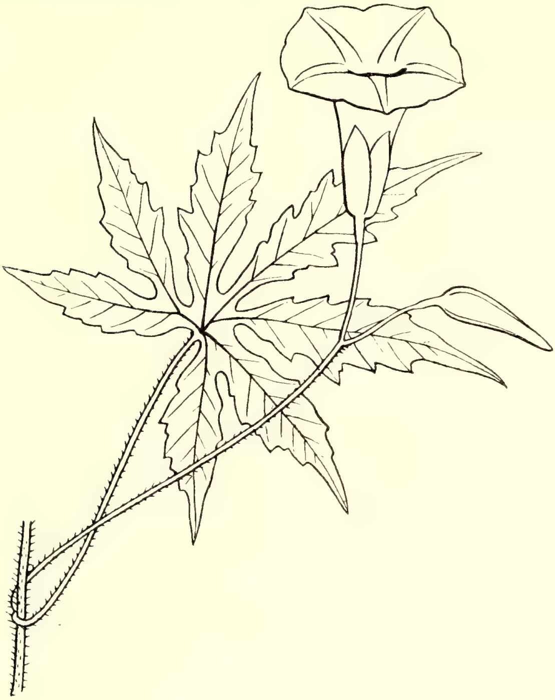

Fig. 10.—*Ipomoea sinuata* Ortega. × ½

Flowers.—October-November. *Fruits.*—November-December.

Distribution.—It is a native of tropical America. Occasionally grown in gardens in all warm countries.

Gardening.—Raised from seed sown in early rains, or by layers of the stem, or division of the roots. It is worth growing for its delicate foliage alone and deserves more popularity. It prefers a moist situation. The flowers usually open widely in Dehra for 2-3 hours at midday as in Texas, where it is known as the 'Noon Flower'.

Medicinal uses.—'The leaves have an odour of oil of bitter almonds and are used in the preparation of the French Liquor known by that name' (Nadkarni). The sap contains hydrocyanic acid.

(*To be continued*).

THE FLAMINGO (*PHOENICOPTERUS RUBER ANTIQUORUM* TEMM.).

BY

CHARLES McCANN, F.L.S.

(*With seven plates*).

INTRODUCTION.

The Flamingo, that oddity among birds, holds almost the same problematic position in the feathered world as does the camel among mammals—both 'compositions of spare parts' left over after Creation! The Flamingo's true position in the scheme of classification is a problem both to the systematist and anatomist. In details its anatomy points to various connections in the world of Birds, but as a complete whole, the relationships are less definable—a real isolation! In keeping with its curious structure, its habits call for the 'considering cap' of the field naturalist. The flamingo is well known, yet a stranger in every sense. It has been, and still is, the subject of many conflicting statements and arguments. Who is to blame? but the flamingo! it is such a 'patchwork' of Nature!

The type of the species (*Ph. ruber ruber* Linn.) comes from the Bahamas, West Indies, but the subspecies *antiquorum*, with which we are concerned, has a wide distribution: 'Southern Europe, more or less confined to the coast-line, practically the whole of Africa and Asia as far east as Lake Baikal and India. In India it is found here and there over the whole continent, south in Ceylon, east to Assam, eastern Bengal, but not in Burma.'[1] In a bird exhibiting such a wide geographical distribution, we must naturally expect in the various localities some differences in habit, varying from the 'standard'. Accordingly, to avoid wordy conflicts, the observer must restrict his remarks to the area studied—there can be no generalizing—the flamingo is as much a victim of circumstance as the observer.

My observations are restricted to India and further limited to the Great Rann of Cutch and portions of Gujarat. I am one of the favoured few who has had the opportunity of visiting the birth place of flamingoes in India during their breeding season. This opportunity arrived when I was detailed to obtain material for a 'group' case in the Natural History Section of the Prince of Wales Museum, Bombay, illustrating the breeding habits of this beautiful bird.

It had long been our ambition to have such a case, but the difficulties were many and the cost prohibitive to our slender means. Mr. S. H. Prater, our Curator, broached the subject to His

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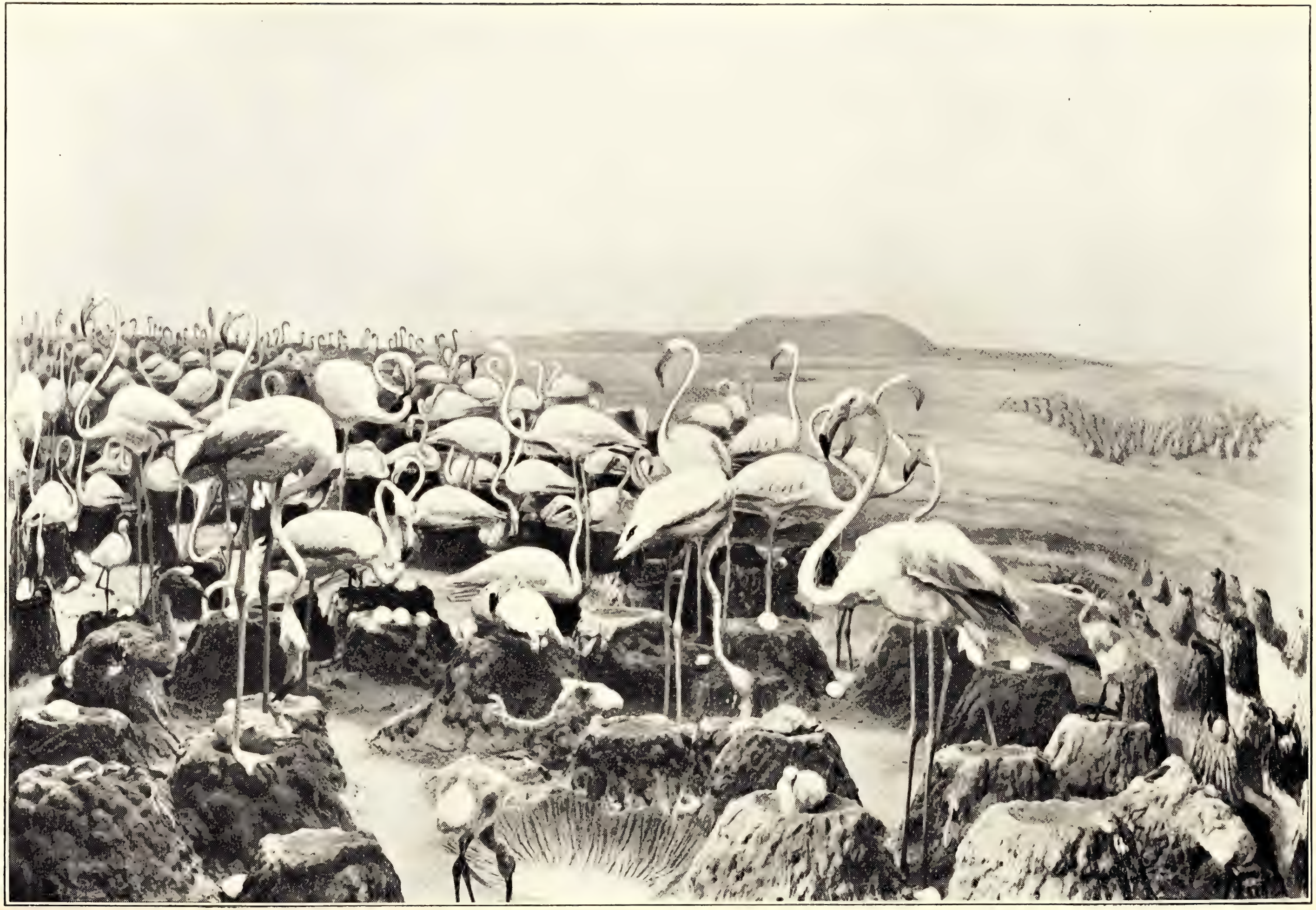
[1] *F.B.I.* (Birds), vol. vi, p. 375.



Highness the Maharao of Cutch. His Highness, an ever generous patron of the Society, very readily offered all the assistance, financial or otherwise he could give. Thanks to His Highness' generosity, the Museum can now boast of a piece of Cutch within its four walls, while the public have, one of Nature's 'extravaganzas' brought to its very door. Our thanks must also be extended to Maharaj Kumar Sahib Vijiaraji who took a keen interest in the project during His Highness' absence from the State, and lastly to Captain V. C. Steer-Webster for his untiring efforts in locating an active colony, and leading the museum expedition to a successful close.

I have endeavoured to record such observations as were possible during my short stay in the Rann, and draw some conclusions from a comparison of the breeding ground in the Rann with those made by observers in other localities where these evasive birds breed.

Discovery of the Breeding Grounds.

The nesting of the flamingo long remained a puzzle to naturalists. Not only were the nesting sites a problem, but, for some unknown reason the incubating posture was also a subject of debate! Some affirmed that the flamingo sat on its nest in the normal way, with its legs bent under it, while others held that the birds sat astraddle! Dampier (*Voyage Round the World*, ed. 2, corrected, I., p. 71, London. 1699.) was responsible for the latter belief. He recorded it as his own observation and the story found its way into scientific literature. The passage is quaint and interesting, and is worth reproducing: 'They build their Nests in shallow Ponds, where there is much Mud, which they scrape together, making little hillocks, like small Islands, appearing out of the Water, a foot and a half high from the bottom. They make the foundation of these Hillocks broad, bringing them up tapering to the top, where they leave a small hollow pit to lay the Eggs in: and when they either lay their Eggs, or hatch them, they stand still all the while, not on the Hillock, but close by it with their Legs on the ground and in the water, resting themselves against the Hillock, and covering the hollow Nest upon it with the Rumps: For their Legs are very long; and building thus, as they do, upon the ground, they could neither draw their legs conveniently into their Nests, nor sit down upon them otherwise than by resting their whole bodies there, to prejudice of their Eggs or their young, were it not for this admirable contrivance, which they have by natural instinct. They never lay more than two Eggs, and seldom fewer. The young one cannot fly till they are almost full grown; but will run prodigiously fast; yet we have taken many of them.' Dampier made these observations prior to 1683 near Querisao (i.e. Curaçāo) near the South American coast. Crespon was the first to doubt this statement in 1844 (*Fauna Mérid.*, ii, p. 69), though he had previously accepted the belief (*Ornithol. du Gard.*, p. 397). He went further to assert that flamingoes did not build a nest, but laid their eggs on slight elevations to keep them out of water. Lord Lilford (*Proc. Zool. Soc.*, 1880, pp. 446-450) obtained a nest, now in the British Museum, from Andalusia, which confirmed Dampier's description of the nests and proved Crespon to be wrong. However, there is the possibility that the nests which Crespon saw were new nests barely appreciable as such, or that they were the shallow type of sand nest, as described by Dr. C. B. Ticehurst from Iraq, which led him to this erroneous conclusion.

In Europe, the Marismas of the Guadalquivir were long known to be the breeding ground of *antiquorum*, but the difficulty of negotiating these dangerous marshes at the breeding season was a real problem. Besides the marismas are tremendous tracts of country. Lord Lilford was first in the field. As early as 1856, he attempted to investigate the breeding grounds, but his efforts and those of Saunders were failures. Later, Crown Prince Rudolph of Austria visited Spain and failed to reach the nesting site, though he found a few eggs on the wet mud of the Marisma. It was not till 1883, when Mr. Abel Chapman and W. J. Buck visited an active breeding colony in the Marismas of Guadalquivir at much risk, that there was some real light thrown on the subject. Mr. Chapman gives a detailed account of his observations in his two fine books *Wild Spain* and *Unexplored Spain.* His observations once and for all set at rest many of the old beliefs and added much to our knowledge of these extraordinary birds. Ten years later another interesting discovery was made, this time in India. Up to that time flamingoes were not known to breed in this country, though sporadic eggs had been found. In vol. viii, p. 553[1] we read a personal letter, addressed by His Highness the Maharao of Cutch, dated 5th October 1893, to Lieutenant C. D. Lester. This evidence was further confirmed by His Highness, with a photograph of the site; in vol. xv, 706, of the *Journal.* Thus His Highness can rightfully claim to be the discoverer of the Indian nesting site.

Almost a decade later another discovery was made, this time in the Bahamas, the breeding ground of the typical race *P. r. ruber*, by Mr. J. Lewis Bonhote, Secretary to the Governor of the Bahamas. Mr. Frank M. Chapman, Curator of Ornithology, American Museum of Natural History, in company with Mr. Bonhote visited the area in April 1902 to study the colony and obtain material for a group case. His observations were set forth in an article in the *Ann. Rep. of the Smithsonian Institution* (1903), p. 573. Much new information was added to our knowledge and older observations were confirmed or refuted. Since these breeding grounds were discovered, year by year something has been added to our knowledge of the life and habits of these puzzling birds.

THE GREAT RANN OF CUTCH.

The Great Rann is a more or less sandy waste, forming a divide between the Province of Sind and Cutch proper. To the north-west an eastern arm of the Indus river once entered the Rann and found an exit to the sea through the Kori Creek, at Lakput. It is now choked up, but at one time sea-going vessels were able to go up this river as far as Ali Bundar. The Luni river enters the Great Rann at the north-east corner; and the Benas, Saraswati and other minor streams from the east flow into the Little Rann. The joint waters of these rivers after flooding the two Ranns find an exit to the sea through the Gulf of Cutch. In the distant past, Cutch (in a restricted sense) was in all probability an island, surrounded by a shallow creek, now replaced by the Ranns. The rivers which enter it drain areas of poor rainfall; have a short, but active life during the rains and, by bringing down enormous quantities of silt, have formed the two Ranns. Undoubtedly the sea contributed to the formation of the western portions and the arm of the Indus, when still active, also played a very active part in the beginning by damming up the north-western entrance of the creek and thereby forming an area of 'still water' into which the rivers from the east deposited their silt, in time filling up the lagoon. Now it is a shallow sea only during the monsoon, and a dry stretch of sand during the dry season. During the flood season it is possible that the flooded area is in contact with sea both north and south. The annual inflow of the sea and its former occupation of the onetime-creek is probably responsible for the salt condition of the Rann.

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[1] *Jour. Bom. Nat. Hist. Soc.*, vol. viii, p. 553.

My impression of the Rann is that it is a low slightly undulating waste stretching for miles and devoid of all vegetation, except on its borders. If we include the Bhunny as part of the Great Rann, this area holds a vegetation with a strong maritime affinity. During the dry season, the Rann is baked dry and hard. Its surface is covered by acres of salt crystals and blistered clay; but in years of good rain it becomes almost a complete sheet of water varying in depth from a few inches to several feet. Bogs and sinking sands are frequent, making it positively dangerous to traverse. Many of the outlying smaller islands are completely isolated. The eastern rivers finding no direct outlet to the sea gradually flood the area. During our stay, there was a general and considerable rise in the depth of the water, noticed on two consecutive days, after which it receded once more. This rise may have been due to a fall of rain in the upper courses of the rivers. The receding appeared to be in a north-easterly and easterly direction—i.e. towards the mouths of the rivers. The water at this period was extremely salty—a mother liquor—, and the crystals formed before the water dried. The temperature was high and consequently evaporation was very rapid. The air vibrated and mirages were common. The glitter from the water and salt crystals was blinding.

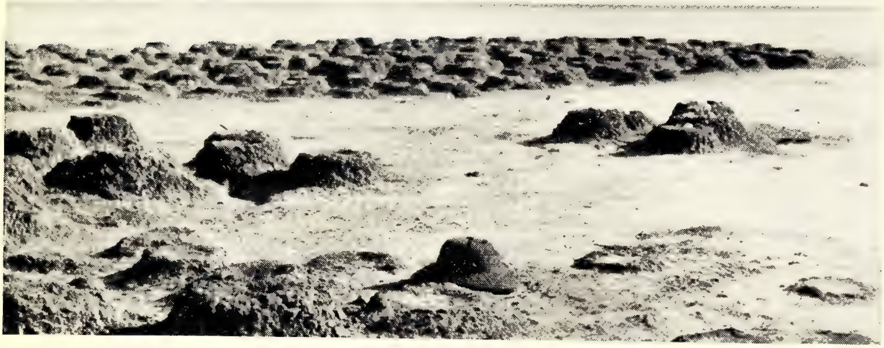
Lying about on the surface there was a certain amount of drift wood, particularly near the 'shore' and in the deeper hollows of the area. In the stream beds that entered the Rann from the bordering hills there were numerous empty shells of land snails, which were sometimes washed into the Rann. Beyond these traces of animal life, which did not belong to the Rann, I could find no microscopical inhabitants in the water, even with a strong lens. Besides the flamingoes, a few Scavenger Vultures, locally migrant birds these, and a stranded grasshopper, the author saw no other signs of life. On the floor below the water there were slimy filaments here and there which appeared to be the remains of some aquatic plants; but for the single occasion on which the author discovered what appeared to be a single seed, there was no sign of aquatic vegetation (see Food). Drinking water is scarce, and even when obtainable on the island, it is brackish. In this dreary, hot and inhospitable stretch the flamingo finds a spot to isolate itself from the rest of Nature and complicate the problem it affords us. The colonies of nests are built miles away from the 'shore' of the Rann.

THE BREEDING SEASON.

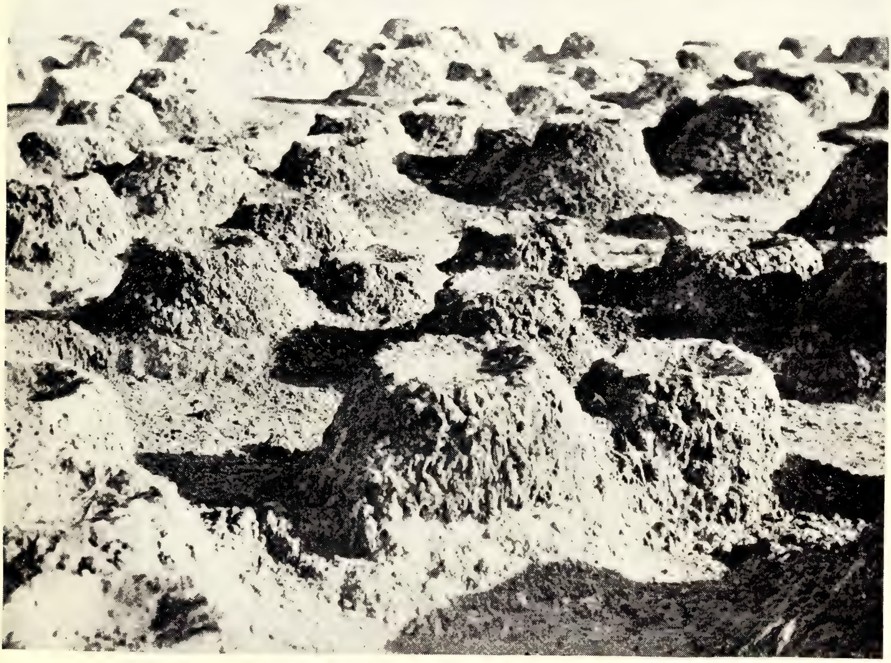
In India the breeding season of flamingoes coincides with the south-west monsoon (in Cutch, July-October). The nesting site each year is dependent on the amount of water present in the Rann, for the nests must be situated in shallow water—the presence of water being the determining factor; incidentally the water must be salt at some period. Likewise in the Bahamas, Mr. F. Chapman notes that 'their nesting is dependent upon the rainy season, which in the Bahamas begins about the middle of May.' Of the Spanish site Abel Chapman says: 'Their doing so (breeding) depends on the season and only in very wet years is the attempt made.' The breeding season in the Bahamas coincides with the breeding season in the Spanish area. This is a very significant point.

The breeding ground in the Bahamas is largely dependent on tidal influence and the heavy rain which 'begins about the middle of May'. Accordingly, the site would depend on the amount of silting up each year along the shores; hence, according to Mr. F. Chapman 'they apparently use a nest only one season. This seemed proven by the nicely graduated series of groups of nests which we found, each one of which, beginning with the best preserved, seemed about a year older than the other and by the fact that the birds were building fresh nests near numbers of others which were seemingly as good as new.' My experience in the Rann was that nests were repeatedly used. But, unlike the Bahamas, the Spanish breeding grounds are dependent on the winter rains alone. According to Mr. Abel Chapman the *marismas* are dry two years out of three! Here lies the snag! Where do the thousands of flamingoes that breed there in wet years go in dry years? and here it is that I venture to offer the following explanation.

On arrival at the Spanish breeding grounds after the winter, finding the conditions unfavourable for nesting, do the flamingoes migrate to other breeding grounds, such as those in Africa, Iraq, and the Great Rann? I feel the possible weakness of such a supposition in the absence of any concrete evidence, but as the breeding is later in India than in Spain, this would



Nest colony of Flamingoes (*P. r. antiquorum* Temm.). Note the shallow nests to the right.
(*The 'topee' shows the comparative size*)



Photos by Author.

Nest colony of Flamingoes (*P. r. antiquorum* Temm.).

give the birds time to come over. The regular breeding season seems to be undoubtedly from May onwards by the coinciding of the Bahaman and Spanish records.

However, acting on this supposition, let us briefly review the climatic conditions prevalent in the various areas during the breeding season. We shall start with the Bahamas, the breeding ground of the typical form, *P. ruber ruber*.

The Bahamas, West Indies.—The Bahamas are described as a group of some 3,000 coral islands and sand banks, which rest on a bank in continuation of the peninsula of Florida. They are all low and have a sandy soil. The climate is 'Tropical, but tempered by cooling sea breezes. There are two seasons, wet and dry. The rainfall in the wet season is frequent and very abundant, with severe thunder storms.' The annual rainfall is from 80 to 120 inches, but from May to October 40 to 60 inches. The islands are influenced by the warm North Equatorial and Gulf Stream currents. The actual surface temperatures are, January 64-72°F., and July 80-88°F.

In the Bahamas the nesting sites are along the shore within tidal limits, Chapman says: "Some were placed among young, others among fully grown mangroves, and one colony, probably inhabited in 1900, was situated on a sand bar 200 yards from the nearest vegetation".

The Spanish sites.—'Though rain is abundant in the north and west of Spain, the country generally suffers from drought.' The Marismas in which the flamingoes breed are chiefly in the basin of the Guadalquivir. This portion of the Iberian Peninsula is mainly dependent on the winter rains—it has a Mediterranean climate. The annual rainfall is 10-20 inches, from November 1st to April 30. The actual surface temperatures are, January 64-72°F., and July 80-88°F. The water entering the Marismas is undoubtedly, at first, only slightly brackish, as there is a luxuriant vegetation (Chapman) and only becomes salt when drying. Hence the food of the flamingoes in the area is probably composed chiefly of seeds and other vegetable matter of the soft aquatic plants with a certain amount of animal life that may be present.

The Great Rann of Cutch: The Rann falls into the 10-20 inches rainfall belt, but actually the rain is very often lower than 10 inches. In years of bad rainfall it is almost dry. The rain falls during the monsoon months (in Cutch, July-October). Actual records for the area are not available. The actual surface temperatures are, January 64-80°F., and July over 80°F. Actual temperatures recorded at the border of the Rann in the shade during our stay were over 90°F. each day, and on one day the thermometer recorded over 100°. The flooding of the area is dependent on the strength of the monsoon, likewise the breeding of flamingoes in a particular area is controlled by these conditions.

Strangely enough the largest and best known breeding grounds fall into a belt north of the Tropic of Cancer, i.e. from 22½° to 38° N. Latitude. The other known breeding grounds are of less importance.

OTHER BREEDING GROUNDS.

Asia, Iraq.—Dr. C. B. Ticehurst records 'On May 21, 1921 Flamingoes were seen on Bubyan Island and a rotten egg was picked up. On April 7, 1922 a colony of about 500 pairs was located on Bubyan up the Khor Milah nesting on a slightly raised stretch of sand covered with low scrub. The nests, situated on bare dry sand within a foot of each other and just above high water mark, were either mounds of sand raised above the level or else the egg was laid on the level sand and the surrounding sand scooped away leaving the egg on the mound. The nests measured one foot in diameter and contained one egg, rarely two. When on the nest the scapulars are raised up in the form of a fan, the nearest approach to the sitting birds was 100 yards. Subsequently the colony deserted[1]; and by May 30, had laid again in another part of the Khor, but most of the eggs had been washed away by a big tide. The young in down swim with ease. On April 1, 1923 no flamingoes were seen on Bubyan.'

Persian Gulf.—The same authority records: 'According to Cummings it breeds on the Koweit side of the Gulf, whence I believe he obtained from the Arabs many eggs which are now in the Karachi Museum.'

Africa.—Layard writes: 'Mr. Chapman also informs us that both the flamingoes found in South Africa breed on Lake N'gami.' Then further, another correspondent of Mr. Layard after indicating various localities in which flamingoes are abundant along the coast says that: 'With rare exceptions (and these not well authenticated, but merely surmised from young birds being sometimes found barely able to fly) the Flamingoes do not breed in any parts of the coast above particularized; and, indeed, the only locality where I know for a certainty that they nest is the inland one of Lake N'gami.'

Cape Verde Islands.—Sclater writes: 'but only known to breed in Cape Verde Island.'

OBSERVATIONS AND GENERAL REMARKS.

Nesting site.—We have already remarked on the condition of the Rann during the breeding season. It is a wide expanse of deep and shallow water. The nests are built in the shallows where there is but a few inches of water. When we arrived the water had already receded to the northward and the colony was high and dry. Only a week previous it was surrounded by water and now the water was about three miles away! We sank a drill to find out how low the level had sunk and also to ascertain

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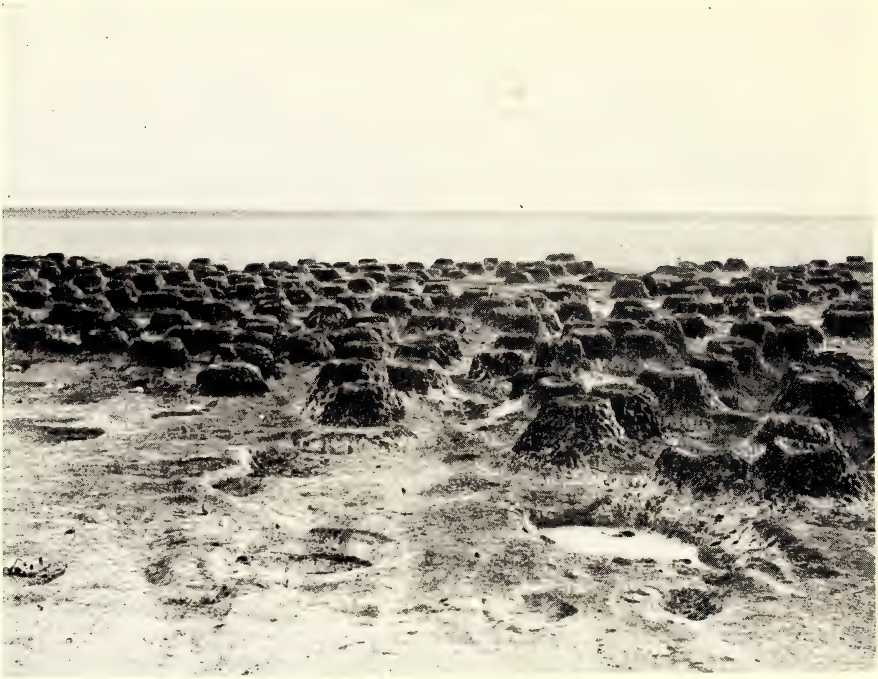
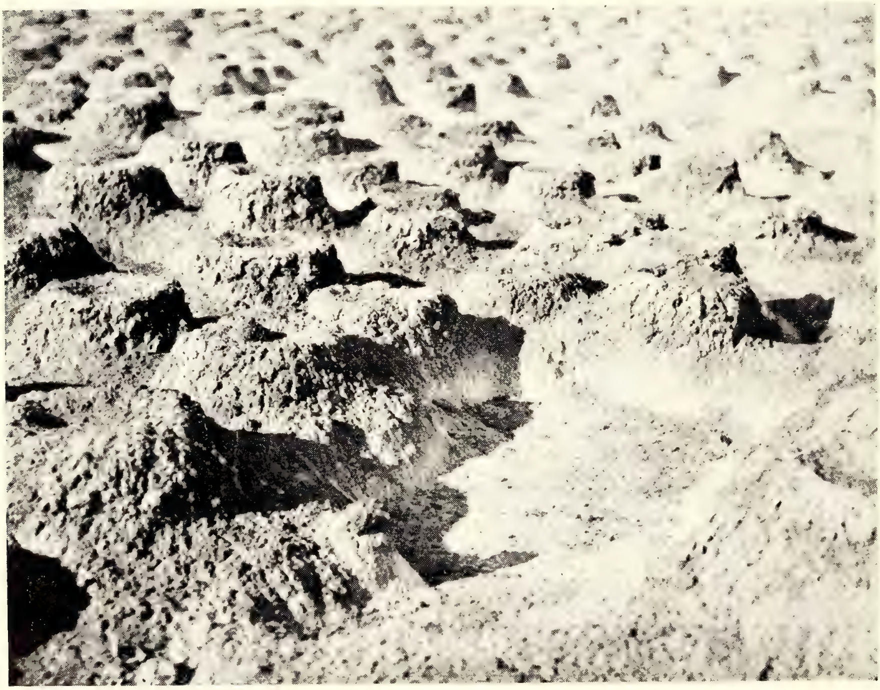
[1] Very probably the birds deserted owing to the absence of water, the nests being built on dry sand above water mark.



Part of a nest colony Flamingoes (*P. r. antiquorum* Temm.). Note the numerous 'scoops' in the foreground.



Photos by Author.

A large 'scoop' among the nests of Flamingoes (*P. r. antiquorum* Temm.).

the nature of the soil. To our surprise the water was already about four feet below the surface. The soil was an admixture of fine sand and clay. The colony at which we worked was a large one, consisting of several hundreds of nests. A few yards to the east was another colony, and a larger one about half a mile away, which seemed as though they had not been occupied this season. The ground round them was covered with a fine incrustation of salt, which gave the place a greyish hue. Scattered around were innumerable eggs and drying corpses of young flamingoes. The eggs were either lying on the surface, or in the nests, or wholly or partially imbedded in the ground, or in the material of the nests. A few feathers were scattered here and there, some imbedded in the nests. The atmosphere of the vicinity was permeated with a strong odour of decomposition emanating from broken, rotten eggs and corpses. The eggs were undoubtedly the legacy of many previous years, as many of them exploded like a gun-shot under foot, and squirted their orange yellow or blackish content in all directions. The sun is probably responsible for many explosions during the hot dry season, but many survive the expansion test.

At the time of our visit the Scavenger Vulture (*Neophron ginginianus*) was always present in the neighbourhood of the nesting colonies, attracted by the many corpses and eggs. We noticed them pulling at the remains and eating the contents of broken eggs. They even tried to break the eggs, but without much success. Taking an egg in its bill, the bird stretches to its full height and forcibly throws the egg down on the sandy surface. Owing to the nature of the ground, the effort is often repeated before the shell gives way. Judging from the number of whole eggs lying about the endeavours were not always successful.

The vista in the early morning before sunrise is just a wide expanse of blue-greys and browns with a dense haze towards the horizon. The distant hills appear as though they floated on a sea of bluish haze. As the sun peeps over the horizon the sober colours give place to lighter and then to more vivid tones. The haze lifts, and the hills come down to earth again with a deep shadow at the foot, but soon this again alters, the air begins to vibrate and the hill tops rise again above a simmering atmosphere. Where there is water, the reflected colours are still more beautiful at sun rise; the sun plays a marvellous tune on the spectrum bands, but the tune is short-lived. The heat dispels the colours as the sun mounts the eastern sky, the water becomes a steel grey and the air begins to dance and play tricks. Mirages appear on all sides. In such conditions the birds are not easy to see and distances are extremely difficult to estimate. It is a real pantomime of phantoms !

Nests.—The nests are built in colonies. In the Rann they are entirely composed of an admixture of clay and fine sand. There is no attempt at incorporating any other material. The occasional feathers that were in some of the nests, were to the author's mind, purely accidental. The mud is collected in the bill, when in a semifluid condition from regular 'scoops' near the colony or from between the individual nests. The semifluid condition of the mud at the time of building is clearly shown by the trickles down the sides of the nests.

The older nests are truncated cones, newer ones are but shallow saucers. The height of a nest may vary, according to age or the depth of water, from barely a couple of inches, to a couple of feet. Age apparently plays an important part in governing the height. A vertical section of one of the largest nests clearly indicated that it had been built upon again and again for six successive years. The sequence of shallow cups with stray feathers and pieces of egg-shells were clearly revealed.

The top of the nest is a shallow saucer barely 1″ to 1½″ deep, quite smooth with an irregular thick margin. The saucer varies from 10 to 14″ in diameter. The width at the base and the conical shape is dependent on the amount of mud that has trickled down the sides. Nests are often interconnected by 'bridges' inadvertently made during construction. Around the colony, though broken in places, there is a definite shallow moat inadvertently scooped out during nest construction. There is no suggestion of the nests having been built on a platform. The colonies vary considerably in size and may be far apart.

With regard to the construction of the nests in the Spanish Marismas Mr. Abel Chapman states that the nests are built on a definite platform 8-12 yards in length and that the nests are themselves rarely more than five to six inches high. The condition of the Marismas very likely calls for such construction owing to the depth of water, or is it possible that the platform is formed under the water by the gradual flow of the liquid mud from the nests in construction? This might happen while the birds are building. It is a possible explanation.

In Iraq, according to Dr. Ticehurst, 'The nests, situated on bare sand within a foot of each other and just above high water mark, were either mounds of sand raised above the level or else the eggs are laid on the level sand and the surrounding sand scooped away leaving the egg on the mound.' Another deviation from the 'usual' construction comes from Africa. Mr. Layard writes: 'Mr. Chapman also informs us . . . Flamingoes breed on Lake N'gami forming a large elevated *nest of rushes*,[1] amid the reeds that surround the Lake.' It seems strange that a bird that usually builds in the open should here build a nest among reeds and of reeds!

Writing of the Bahama colonies, Mr. Frank Chapman says:—'The thousands of nests seen were built of mud, which the nests in process of construction showed was scooped up from about their base. In fact it is difficult to conceive of a flamingo carrying mud. In selecting a nesting site, therefore, the bird is governed by the condition of the ground, which, to be serviceable, must be soft and muddy.' Referring to the above statements, Mr. Chapman rightly remarks that 'the bird is governed by the condition of the

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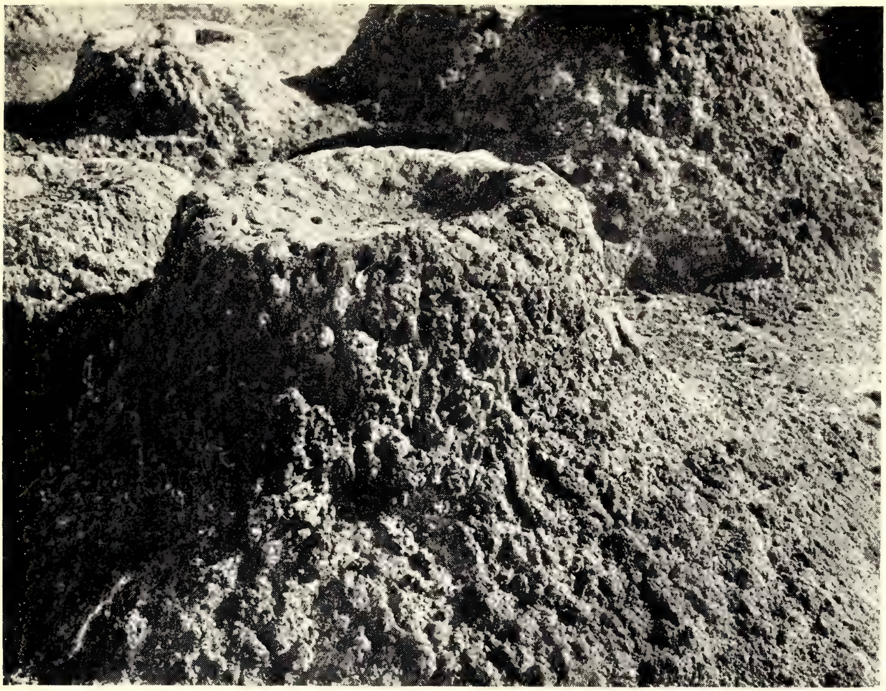
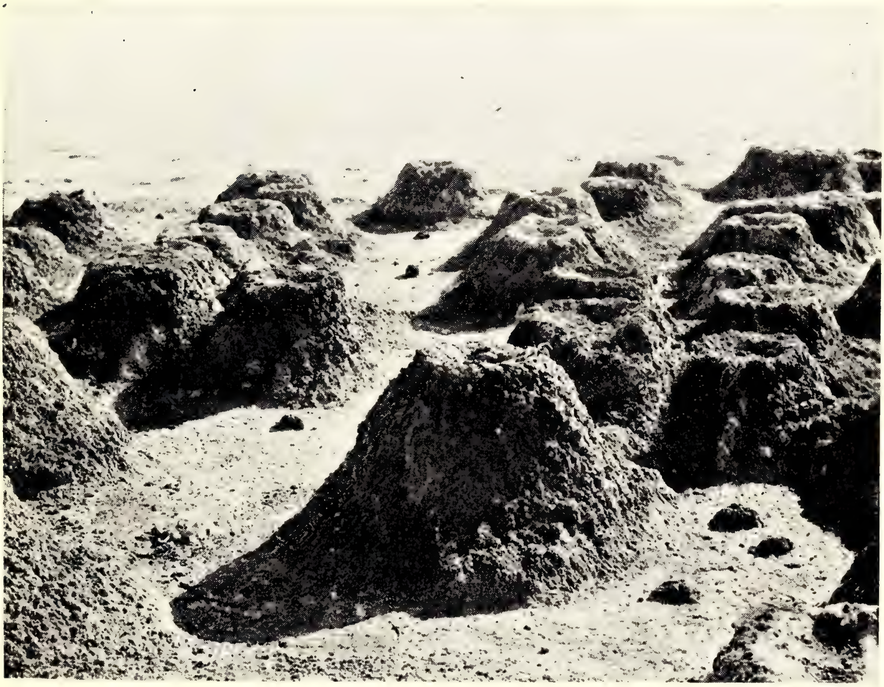
[1] Italics are mine.



One of the largest nests in the colony, (*P. r. antiquorum* Temm.).



Photos by Author.

Some of the largest nests in the colony. Note the old eggs in the foreground covered with mud.

ground, etc.', but I do not see why he doubts the possibility of flamingoes being able to carry mud! My photographs clearly show that the scoops are frequently some distance away from the colony. One general scoop was several feet in diameter and about four to five yards away from the colony, so that the mud was evidently carried that distance to the nests.

Referring to the size of the nest, the same authority writes:—'The popular conception of a flamingo's nest makes it not more than 6 or 8 inches in diameter at the base, whence it tapers to a truncate, hollowed top nearly 2 feet in height. I saw no nest, however, over 12 inches high, and most of them were not over 8 inches high. The average basal diameter was about 13 inches, that of the top about 10 inches.' The nests in the Bahamas are considerably smaller than those of the Rann. This, however, may be explained by the fact that the nests in the Rann are built on in successive years, whereas those of the Bahamas are only occupied for but a single season. The bases of some of the largest nests in the Rann were almost a yard wide, the reason for which has already been explained.

Eggs.—The eggs, in size and shape, vary from a broad and regular ellipse to a narrow ellipse with one pole more pointed than the other. The *Fauna* records the average of 100 eggs as 88.5 × 54.5 mm.: maxima *103*.5 × 56.5 mm. and 93 × *61.0* mm.: minima 77.*0* × 48.5 and 94.5 × *47*.7 mm. Of thirteen eggs measured by the author the average was 82 × 56: max. 100 × 59: min. 75 × 55 and 88 × 53. The shell, though thin, is fairly strong and chalky white in colour. The colouring of the contents of the eggs examined varied from a bright orange-red, orange-yellow, to almost black (the latter being the result of decomposition). In many instances the eggs were so bad, that when drilled, the contents shot out to a distance of several feet. The period of incubation remains unknown. 'Both sexes incubate; one by day the other by night' (F. Chapman). 'When on the nest the scapulars are raised up in the form of a fan;' (Ticehurst).

In Spain the eggs of the flamingo are eaten. Mr. Abel Chapman says, 'egg poachers carried off thirty arrobas (750 lb.) of flamingoes' eggs—some being still left behind as the canoes could carry no more!' Again, 'these eggs are said to be the worst eating; but in hungry Spain, "two will make a dinner for a family".'

Dropped eggs.—The *New Fauna*[1] records: 'The Flamingo has a curious habit of dropping eggs at odd times before and after the usual breeding-season and such eggs have been picked up by Barnes, Hume and others in India.' Blanford[2] referring to the same habit writes: 'but it should be remembered that in North-western India these birds are migratory, arriving about October, and remaining, if there is water, till May or June, and that around the Sámbhar salt lake, where they abound in the cold season, their eggs have frequently been found, irregularly scattered, *about May*

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[1] Stuart Baker, *F.B.I.*, vol. vi, p. 375.

[2] *F.B.I.*, vol. iv, p. 409.

and have occasionally been met with in November,[1] but the birds never sit on such eggs.'

Blanford's statement shows that there is good reason to believe that this 'indiscriminate dropping of eggs' is in reality occasioned by either disturbance or lack of a breeding site at the time when the birds are in breeding condition—or about to lay their eggs. Unsuitable circumstances at such a time would undoubtedly result in the laying of the eggs anywhere—the birds no longer being able to control the passage of the eggs, must of necessity drop them. The timing, as stated by Blanford, certainly appears to support this statement, particularly in the absence of the *exact* time when the eggs were laid. The eggs may have been laid weeks or even months previous to the date of their finding. Though numbers of eggs found in the Rann were apparently 'fresh', the author would not like to make a definite statement—the contents appear to 'keep' for a long time. Thus in my opinion, the occasional dropping of eggs in odd places is beyond the control of the birds and eggs are laid wherever they may be at the time of maturation.

Chick.—The chicks are clothed in a dense cotton down. The youngest ones varied from a greyish-white to almost white, the down being suffused with light brown in places. Below, the upper seems to give place to an under-down. The brown intensifies till the appearance of the darker primaries. The bill and feet in young birds are dark brown, almost black. They gradually change to a slaty black and finally to dull slaty blue. The eyes are entirely black. Wandering about in this garb in the greyish and brownish background of the Rann the chick is almost invisible, even at a short distance—further away against the skyline their bodies merge into the vibrating atmosphere.

According to Mr. F. Chapman,[2] 'they (chicks) remain in the nest three or four days and during this period are fed by the parents on predigested juices of a mollusc of the genus *Cerithium*. They also eat the shell of the egg from which they have so recently emerged.' To witness this observation in the Rann the author was too late, but it was clearly evident that the young soon fend for themselves. The expedition secured very small chicks miles away from the nesting site, feeding in company with their elder brethren. On leaving the nest the chicks congregate in large parties, sometimes composed of several hundreds. They vary greatly in size in the same 'crowd', for a dense crowd they are. The year of our expedition was evidently a 'bumper' year for flamingoes, the young were there by the thousand, real thousands! As the water recedes from the nesting site they follow in its wake and commence their juvenile march feeding as they go—there is no return. This march must last for weeks, till they are eventually able to fly. The line of march is marked with corpses and remains of hundreds of young birds, while in the water float the dead and the dying. Weaklings, not able to keep pace with the main body

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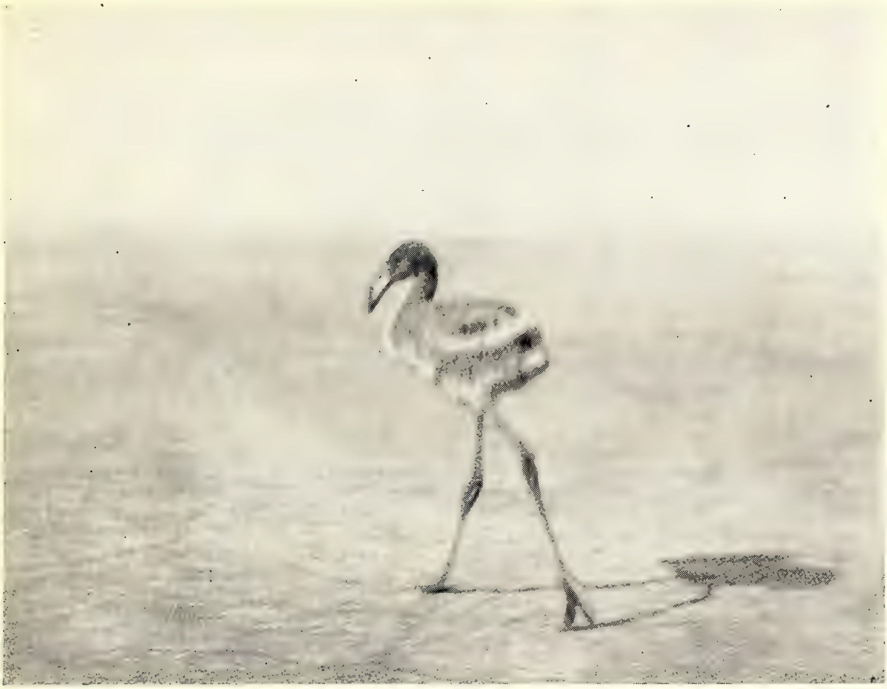
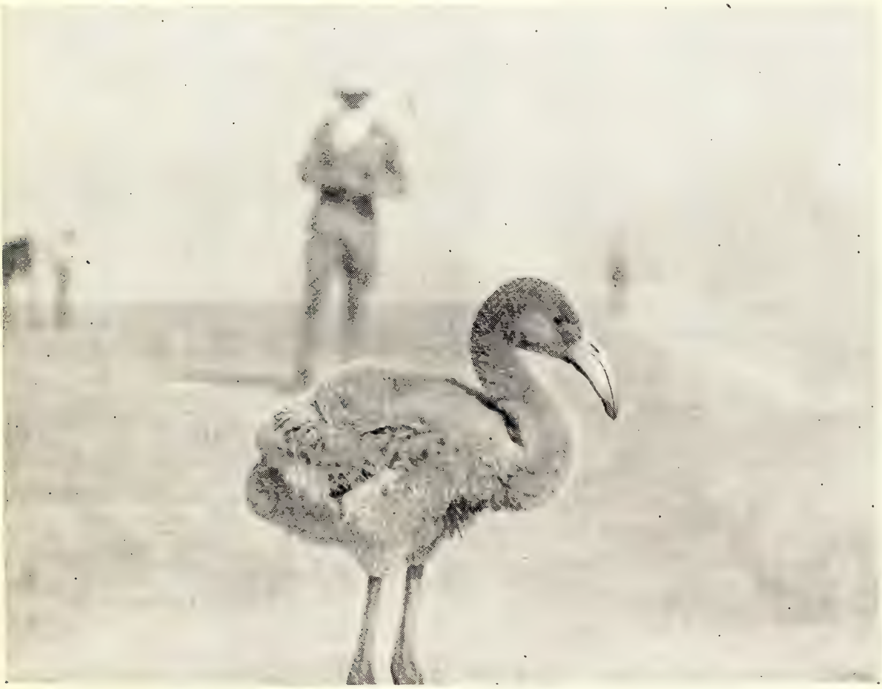
[1] Italics are mine.

[2] *Natural History, J. Am. Mus. Nat. Hist.* (Guide leaflet No. 28), (1930), p. 39.



A three week (?) old Flamingo chick (*P. r. antiquorum* Temm.).



Photos by Author.

A 'close-up' of the same chick.

and the receding water, wander about the desert aimlessly, till death mercifully comes. The mortality appears to be exceedingly high, and is due mainly to starvation and exhaustion.

Healthy chicks run quite fast and it requires a good effort on the part of a man to catch them, as they dodge here and there; but weaklings are easily caught. In the shallow water the incessant patter of their feet is audible at a fair distance. While feeding they keep up an incessant calling, which can only be compared to the call of young Indian Paroquets (*Psittacula eupatria*) clamouring together for food. Their combined voices could often be heard for about a mile or more. (Distances were too difficult to estimate and could only be calculated by walking or riding time.)

The flamingo in its youth has to be a good walker and runner —it has to walk into adult life! Apart from being a good walker it is also a good swimmer and is able to maintain a steady pace. By the time the water in the Rann has receded and the chicks are able to fly they must have covered many miles. The march, like the receding water, is in a north-easterly and easterly direction, towards the mouths of the rivers.

Immature plumage.—Though we did not obtain any birds at this stage in Cutch, there are two in the collection of the Society showing this phase, and a few observations on these will not be out of place. One is from Ganoweh, Persian Gulf, shot on 6 February 1925 (Capito), and the other from Bhinder, Salsette Island, obtained on 13 September 1913 (Kinloch). The Indian bird appears somewhat younger than the Persian Gulf specimen. In the Indian bird the head and half of the neck still show the smoky brown juvenile feathers while the rest of the neck and body are white. The feathers of the back are much worn. The wing feathers are blackish brown. The terminal third of the wing coverts are brown. The axillaries are rose-pink with brown terminations. Some of the wing coverts are tinged with rose-pink. The Persian Gulf bird is in very much the same condition, except that the coverts and axillaries are much more pink.

In my opinion, most of the feathers, including the axillaries, which at this stage show brown are entirely brown at an earlier age; the brown gradually fades out from base towards tip becoming quite white (canesence), except those feathers which are black in the adult bird. At the same time there is a gradual suffusion of rose-pink in feathers which in adult life are pink. That such a fading of the brown and a suffusion of pink does take place is clearly shown in these two specimens. Therefore the transformation is not by moult. I have noticed a similar transition in the Peacock.

Adult plumage.—In the adult, in non-breeding plumage, the wing-coverts, etc., are rose-pink, brightest on the coverts and axillaries, but during the breeding season the same areas are scarlet and the whole of the white plumage is covered with a pink, evanescent bloom. This was most remarkable in the birds shot in the Great Rann on the breeding grounds and absent in the birds shot at Mandvi, the latter were the paler birds and were without the bloom. After death much of the bloom disappears.

Sexes.—The only difference in the sexes appears to be size—the males were larger than the females.

Moult.—Newton writes,[1] 'Late in the summer the adults shed all their quill-feathers, and being thus rendered flightless, are easily captured.' I can find no evidence in support of this statement, and it appears to be most unlikely that this should happen when the birds are at the height of the breeding season! This was certainly not the case in the Great Rann. Traces of the general moult would have been visible. The only explanation of this statement is that young birds, as yet unable to fly, were mistaken for birds undergoing moult.

Beak.—The bill of the young bird is quite different from the characteristically deflected bill of the adult. In newly hatched young it is straight with a distinct hook to the tip of the upper mandible without the slightest suggestion of a bend. When the chick is about two weeks old (ages are based on comparison and are therefore not exact), there is a slight tendency to a downward curve in the upper jaw and the lower is decidedly curved. In a chick a couple of weeks older (3-4 weeks) there is a very definite increase in the curvature of both jaws—it now has an aquiline nose. Henceforth the curvature increases till the adult shape is attained.

The margins of the upper mandible are flexible along their length, and are beset with lamellae of varying length from the gape forward till the point where the bill bends downwards. These lamellae are movable. From the point of deflection forward the lamellae become somewhat larger, and wider apart till about a centimeter from the tip. The lamellae of this region are rigid. On the interior surface of this mandible there is a median ridge which is quite smooth. Between the lamellated flexible margins and the median ridge, there are oblique grooves pointing backwards.

The margins of the lower jaw are broad and strongly inflexed and are covered with oblique short lamellae corresponding to the grooves in the upper jaw. The internal surface of the lower jaw is quite smooth. The marginal inflection is so strong that the tongue cannot possibly leave its groove—an adaptation due to the 'up-side-down' process of feeding. A flamingo cannot put its tongue out!

To my mind, the lamellae aided by the papillae of the tongue help to sort the food from the sand and mud allowing only fine sand and mud to escape, while larger grains, useful in the gizzard, are retained by the stiff, distant lamellae of the forepart of the upper mandible, thus regulating the size of the granules entering the gizzard. The gizzard is always full of only small granules of sand—no large pebbles.

Tongue.—The tongue is slotted in the groove of the lower jaw and can only be moved backward and forward. The rear two-thirds is thick and muscular, the remaining tapers down to a fine

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[1] *Dictionary of Birds*, p. 256.

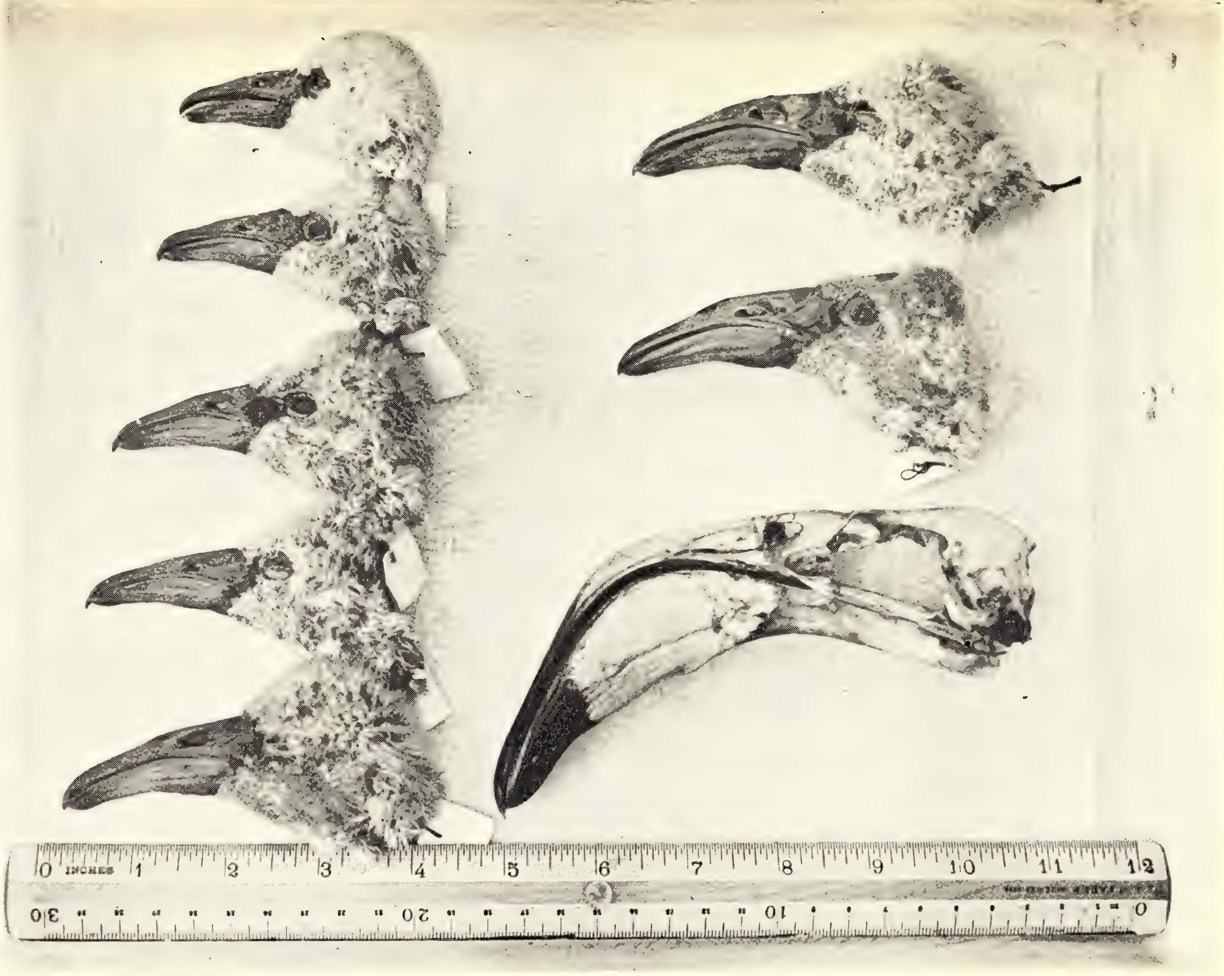
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Photo by Author.

Bills of Flamingoes (*Phœnicopterus ruber antiquorum* Temm. showing the gradual formation of the characteristic curvature of the beak.

Plate VII

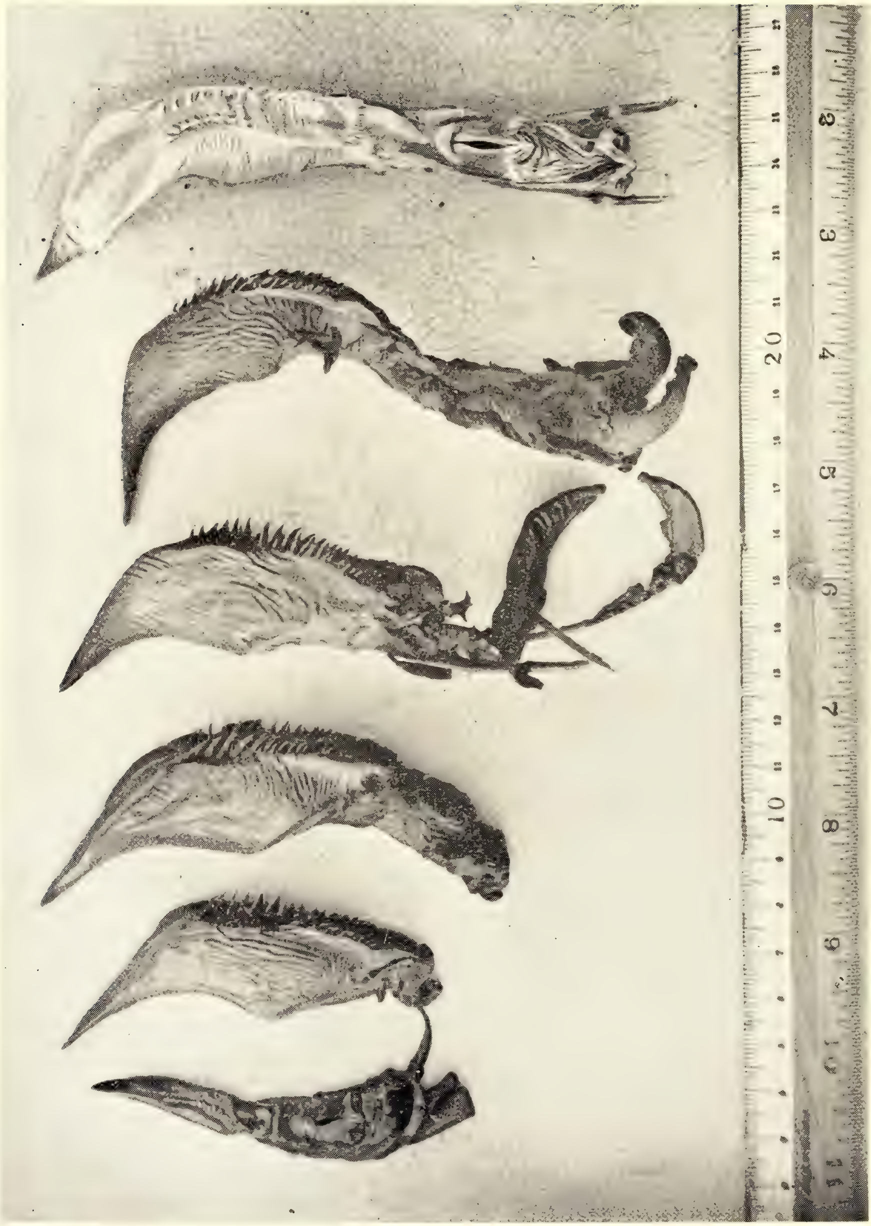

Photo by Author.

Tongues of Flamingoes (*Phœnicopterus ruber antiquorum* Temm.) showing the papillae.

point. Viewed from above, the tapering portion is a leaf-like expansion. On the thick muscular part there are two parallel rows of stiff papillae increasing in size as they go forward, then decreasing slightly again. At the point where the papillae end, the tongue turns almost abruptly downwards, coinciding with the deflection of the bill. Between the rows of papillae there is a shallow median groove receiving the median ridge of the upper jaw. On the lanceolate expansion is a low median ridge running from the tip backwards for about three-quarters the way up, with smaller oblique ridges running forward. At the back of the tongue there are two groups of pectinate papillae, one on each margin and the other two forming two fan-shaped groups between.

The long marginal papillae operate backwards and forwards against the marginal lamellae of the lower jaw and in their tips in the grooves of the upper jaw.

Parental care.—As we have seen, the parent birds feed the nestlings for about three or four days, but after that there is no doubt that the young have to fend for themselves. With the parties of young in the Rann there were never more than about half a dozen adults, usually only one or two. The adults act as sentries and marshal the young together. Amid the shrill chorus of young the deep goose-like 'honk' of the adults was frequently heard. At night the number of adults with the young is not augmented. How this system of sentries is arranged remains a mystery, but I am inclined to believe that only the males act as sentries, as only males were shot in the Rann with the young. If this is really the case then it is an Anserine character.

That the guardians herd the young together is clear from the following incident. One morning when trying to secure an adult we circled a party on horseback. I dismounted and tried to make myself as inconspicuous and motionless as possible, while the rest of the party drove the birds towards me. The ruse worked well for a time, the chicks came on beautifully with the old bird bringing up the rear. Then suddenly the old bird ran up to the fore, while the young were still out of range, turned its back to me, and as it were, drove the chicks away in another direction, flapping its wings all the while. The action seemed deliberate. Only when I attempted to follow up did it take to wing. By this time the young had gone far into the water.

Food.—With the question of food, there arise several other problems which have a definite bearing on the subject, as far as the Rann is concerned. Though the Rann in the area visited is apparently an absolute desert, the flamingoes must get *something* to feed on, or they would not select such a locality for nesting, more so as the chicks have to fend for themselves—But what do they find? We examined the ground carefully for molluscs, etc., and the water for crustaceans, but no trace of living matter could be found even with a powerful lens. An examination of chicks' stomachs showed that besides a quantity of sand, they contained nothing except a collection of small black seeds! The questions now arose, (1) What were the seeds? (2) How did they get there in such quantity as to sustain thousands of flamingoes?

Then again on examination the stomachs of the adults were found to contain, besides some of the same black seeds, some brown seeds, and small portions of aquatic plants resembling *Naias* and *Chara*. The adults being able to fly undoubtedly visited other feeding grounds, for I am positive that the three last mentioned items do not occur in the Rann. Later we discovered that large numbers of flamingoes visited the marshes not far from Kawra. The swamps revealed that acres of ground were covered with various sedges, *Scirpus maritima* in particular. In the water there were other aquatic plants. The brown seeds found in the adults were those of *S. maritima*. So this then was the source of their food. The identity of the black seed of the Rann remained to be determined.

On my return to Bombay I was able to fix the identity of the black seed as that of *Ruppia rostellata*, an inhabitant of slightly brackish water. *Ruppia* is unable to withstand salt water, therefore there must be some explanation for the presence of its seeds in the Rann. There was no trace of aquatic vegetation in the Rann and Captain Steer-Webster affirmed that he had never seen any at any time he had visited the Rann. But, here and there I did find some filamentous structures which appeared like threads of slime. In this I found a single seed. This material on further examination could not definitely be ascribed to any plant, but the seed was the same as those obtained from the flamingoes. The only explanation I have to offer on the subject takes us back to the topography of the Rann and its immediate surroundings. As already indicated, the eastern rivers are largely responsible for the flooding of the Rann, their waters spread rapidly over the surface dissolving the saline deposits. The salinity of the water is at first low—saline enough to encourage the growth of *Ruppia*. This means that *Ruppia* must mature very rapidly, before the salinity increases to such a degree sufficient to kill off the plants. Incidentally, the seed has a hard seed-coat which is impervious to the brine and able to withstand a high temperature during the dry months. If we accept this explanation, it is fairly clear that the Rann is flooded with fresh water. Rain alone (in an area where the rainfall is very low) cannot be responsible for the flooding. That the area is not inundated by the sea is clear from the presence of *Ruppia*—it cannot grow in salt water (sea water), but when the Rann is flooded to its fullest it is possible it joins up with the sea to the west, north and south of Cutch, i.e. with the Kori Creek and the Gulf of Cutch. The periodical connection with the sea may go a long way to accounting for the salinity of the water and deposits in the Rann—by diffusion—apart from the one time existence of a shallow arm of the sea round Cutch proper. It is clear that the flamingo chicks must depend entirely on the existence of *Ruppia* in the Rann—in other words on an entirely vegetable diet.

Stuart Baker[1] writes: 'We know that a considerable part of their diet is vegetarian, but they are also in all probability far more given to animal food than has generally been believed to be the case. Mr. Eagle Clarke, in his interesting article already referred to, came to the conclusion that the flamingoes inhabiting the Rhone Delta existed almost entirely, if not quite, on a tiny Phyllopod, the brine-shrimp (*Artemia salina*), which he states is found there in marvellous abundance.' In this passage the statement is a general one, not differentiating between chicks and adults.

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[1] *Indian Ducks and their Allies* (1908), p. 6.

In the Bahamas, Mr. F. Chapman tells us, 'The singular shape of the bill of the adult Flamingo is related to the manner in which it secures the small spiral *Cerithium* shells which, in the Bahamas, appear to constitute its only food.' In this case the food is evidently maritime throughout.

Colouring of adults.—The question of animal colouration, its meaning, and how it is arrived at, is a much disputed question. The factors giving rise to animal colouration are so very complex, that I make no pretence at explaining the problem of flamingo colouration, but merely advance certain deductions from facts observed by myself and others which may contribute towards a solution of this interesting problem.

In the Bahama birds, *Ph. ruber ruber*, the entire plumage is bright crimson throughout, and what is more, it retains this colour throughout the year. Under captive conditions the bright colour is gradually lost till the bird is almost pure white. Experiments have shown that the brilliant colours can be restored by special methods of feeding. Thus Pycraft[1] writes: 'To begin with, it is well known that many brilliantly coloured birds become more or less pallid in captivity. This is especially noticeable in the case of the American Rosy Flamingo (*Phoenicopterus ruber*). These birds invariably lose their colour in confinement and become almost white. This pallor, it has been shown, is due to the reaction of the unfavourable climate, but it is intimately associated with the metabolism of the body, a fact which has been demonstrated by experiment. Mr. Beebe, the Curator of the Zoological Gardens of New York, appears to have been the first to demonstrate this point'. "In captivity," he remarks, "these birds (American Flamingoes) fade out moult by moult, until they become almost white, like the European species. By mixing with their food a quantity of some strong but harmless dye, I have had them either retain their original colour for years, or at least the fading process has been appreciably lessened. In the Gardens of the Zoological Society of London this experiment has been carried out to a yet more satisfactory ending, for in place of the 'strong, but harmless dye' these birds were turned out into a paddock where they had free access to a large pond well-stocked with small crustacea, a diet which quickly restored the lost hues. This is of particular interest, because it has been already shown that the characteristic colour of the flesh of a salmon is due to the red colouring matter extracted from the crustacea on which it feeds. Thus as in the case of cayenne-fed canaries. . . ."

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[1] *A History of Birds*, W. P. Pycraft (1910), p. 315.

'The European Flamingo (*Phoenicopterus roseus*), it is significant to note, though feeding on precisely similar diet, has only the wings, beak and legs vividly coloured, while the rest of the body is merely flushed with rose-pink.' Does this factor then really operate in the wild flamingoes? Is the subspecies *antiquorum* then merely a bleached form of the type, due to differential feeding? If differential feeding is partially responsible for the colouration of the subspecies, is the difference due to the difference in food of the chicks of the two subspecies, that it has a permanent result? These are the questions we are now faced with and to answer them we must return to the breeding grounds as the chicks are confined to the breeding area.

The chicks of the typical race and of the subspecies are undistinguishable. In the Bahamas the nests are built along the shores of the islands within *direct tidal influence*. The water that inundates the area is *sea water*, perhaps slightly tempered with the limited amount of rain flowing off the land. Nevertheless it is highly saline and the fauna along the shore is truly marine, therefore the birds, both young and old are dependent on the marine fauna for their food and perhaps also on a slight admixture of seed washed from the land during floods. We have already noted the change in captive birds—the captives regained their normal colouring!

In the Marismas of Spain conditions are different. The flooding of the area is dependent on the winter rainfall and the flooding of the Guadalquivir. This area is not *under direct tidal influence*, therefore the waters of the Marismas are, at first, probably only slightly brackish passing eventually into brine as the area dries up. Accordingly the vegetation is totally different to that of the shore of the Bahamas, though there are a few 'maritime' species within the area. Aquatic and 'amphibious' plants are fairly abundant and the progression from the 'fresh' to the saline condition must vary. In short, the abundance of plant life means an abundance of seed and other vegetable food. Likewise there is probably a transition in the aquatic animal life. So evidently the young flamingoes of this area are more dependent on a vegetarian diet than those in the Bahamas.

In the Great Rann we find conditions somewhat similar. This area is not under *direct tidal influence*, and like the Guadalquivir the area is dependent on the monsoon and the consequent flooding of the eastern rivers. The temporary connection with the sea is soon severed when the water begins to dry up. At the time of our visit there was no visible vegetation in the Rann, but we found that the birds were subsisting on the seeds of *Ruppia*! As indicated the plants must flourish during the early part of the flooding and die out, leaving large quantities of seed as the water becomes more saline. Is this then an explanation of the difference in plumage seen between the type *P. r. ruber* and the subspecies *P. r. antiquorum*? A question of food in the young?

That young birds only acquire their rosy hues when they reach the sea is clearly evident, for when they first leave the breeding grounds they have no rose colour on them. This is of course true of *antiquorum*. Therefore the colouration is certainly correlated with the quality of the food. *Antiquorum* seems to be more of a vegetarian than *ruber*. However, further evidence and experiment is necessary on all these points.

Migration.—That birds migrate periodically from one country to another or from one locality to another within the same country is a well-known fact. That birds are compelled to migrate either due to climatic conditions which govern their food supply or their nesting site is equally well known. These same factors evidently govern the movements of flamingoes, their nesting sites are governed by the presence of water—no water, no nests, and no food for the young. However, there is this difference between the typical *P. r. ruber* and *P. r. antiquorum*: the former is less of a migrant owing to the fact that it is more litoral in habit, therefore more certain of water supply at the time of nesting; whereas, the latter is far more lacustrine and therefore dependent on rainfall for its nesting site and supply of vegetable food.

As marshes are dependent on rainfall, if the birds are to exist, they must be prepared to find new breeding grounds in years of bad rainfall. Perhaps this may go a long way to explain the wider range of the subspecies *antiquorum*. If we take into consideration the position of the three known, major breeding grounds of flamingoes, viz. the Bahamas, the Spanish Marismas, and the Great Rann of Cutch, we find that two of the three (Bahamas and Rann) are almost on the Tropic of Cancer, while the third is just 15° north of this line. Some of the minor sites are just north of the Tropic of Cancer. Therefore we may safely conclude that the flamingoes belong to the northern hemisphere.

Now we come to the migration of *P. r. antiquorum*. Perhaps it would be best to begin with Spain. Mr. Abel Chapman's comments on these birds in Spain are of interest:—

'Flamingoes ignore the limits of continents, and shift their mobile headquarters between Europe and Africa as the respective rainfall in either happens to suit their requirements. Hence whether by day or night, the sight or sound of gabbling columns of flamingoes passing through the upper air is a characteristic of these lonely regions, irrespective of season. . . .' (p. 40).

This passage seems to indicate that flamingoes may inhabit the Marismas all the year round. Writing of the permanent pools during the month of February after a bad year Mr. Chapman says:—

'Approaching the first of the great *lucio's*, or permanent pools, a wondrous sight lay before our eyes. The water might extend for three or four miles, but was literally concealed by the crowds of flamingoes that crowded its surface. For a moment it was difficult to believe that those pink and white leagues would really be all composed of living creatures. Their identity however became clear enough when, within 600 yards, we could distinguish the scattered outposts gradually concentrating upon the solid ranks beyond. Disbelieve it if you will, but four fairly sane Englishmen estimated the crowd, when a rifle-shot set them on wing, to exceed the thousand units—by how much we decline to guess.' Such then are the hordes to be seen in the Marismas just before the breeding season—May. Therefore, as the Marismas are dry in years of bad rainfall these thousands must find new quarters. Where then do these flamingoes go? The probable answer is to other suitable places in the distribution—east and south.

From the present state of our knowledge, it appears that the majority of the breeding birds keep within the north and south limits of the Tropics of Cancer. The southern records of the breeding grounds are imperfect—we know a little more of the eastern sites. Hence it would be better to start with the eastern 'migration'. Dr. Ticehurst[1] observed flamingoes on Bubyan Island and picked up a washed up egg on 21 May 1921. On 7 April 1922 he located, on the same island, a small nesting colony, which had built sand nests, but these birds deserted the locality and laid again in another part on May 30 (1922). In the following year, 1 April no flamingoes were seen on Bubyan. In another paper the same author[2] writes: 'The flamingo is a not uncommon resident and in some favoured localities it may be said to be abundant, such as in the marshes round Meseyib. But almost anywhere where suitable inundations exist some may be in any month of the year, the flocks moving about locally according to the varying conditions of the marshes. Doubtless many move away to their nesting haunts in the breeding season, but a good many non-breeding and immature birds remain behind. According to Cumming it breeds on the Koweit side of the head of the Gulf (Persian Gulf) whence I believe he obtained from the Arabs many eggs which are now in the *Karachi Museum*. The Flamingo is generally distributed throughout our area.'

Dr. Ticehurst's observations indicate two points (1) that under certain conditions flamingoes breed in Mesopotamia (2) that certain birds do not join in the usual breeding—possibly immature birds which may reside in the area till the next season. Incidentally, from the same observations we see that the Mesopotamian season coincides with the European season. Another note in the *Journal* by Capito[3] records: 'Not often seen, a specimen was obtained near Ganoweh on February 6, 1925. Witherby saw two at Bushire on March 18 (1925).' The specimen referred to is a juvenile in the Society's collections. Another Persian record is that of Buxton:[4] 'I saw a flock of a dozen adult flamingoes in July at Rula Rud, midway between Enzeli and Astara.' Now we come to the Indian border. Tenison[5] observes: 'On 21st October 1908 saw a large flock flying east down the Kabul River . . . about 500. 7 March 1909 I saw another large flock flying west up the Kabul river and again more on the 8th, possibly parts of the same flock.

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[1] 'Additional Notes on the Avifauna of Iraq.' *J.B.N.H.S.*, xxxi, p. 110.

[2] 'Notes on Birds from Northern and Western Persia.' *J.B.N.H.S.*, xxvii,

[3] 'Some Birds in the N.-W. Corner of Fais, Persia.' *J.B.N.H.S.*, xxxiv, p. 931

[4] Notes on Birds from Northern and Western Persia. *J.B.N.H.S.*, xxvii, p. 875.

[5] 'Flamingoes in the N.-W. Frontier Province.' *J.B.N.H.S.*, xix, 525.

I mentioned it to Captain Bogh of the Guides, who has lived at Mardan for some years, and he told me that he had never heard of them in this province. However he told me yesterday (15th March 1909) that within the last few days several birds had been seen in the neighbourhood of Mardan which are undoubtedly Flamingos.'

That flamingoes breed in India during favourable seasons, in the Great Rann of Cutch, is definitely established. The only question is, do Spanish birds breed there in years when they cannot breed in the Spanish area? Which would imply that they are migratory to a certain extent. The monsoon in Cutch is late, i.e. July, this would give the birds ample time to come over from Spain. Of course, this is a mere supposition and further proof is required, which would mean the wholesale ringing of birds in the two areas. That juveniles are resident in India for at least a certain period there seems to be no doubt.

In India the flamingo goes far to the south entering Ceylon, where it was at one time supposed to breed, but no evidence on the point is forthcoming. Biddulph[1] records:

'A fairly common bird seen on the island during the period November to March each year. Only found at the extreme south end where shallow lagoons are formed on both sides of the railway line. Most of the birds frequent the birds along the eastern shore, but some parties cross over to the western side late in the season.

'They usually arrive at the end of November, when a few hundred birds are suddenly seen one morning. The numbers rapidly increase until it is estimated that about three thousand birds gather in this area.

'The winter of 1929-30 apparently suited the birds better than that of 1930-31, as they were very numerous and never left the island for short periods once they arrived. They finally left on 12-3-1930.

'In the winter of 1930-31 the birds arrived on 13-11-1930, but left after a week and only returned again during the first week of December. On 8-1-1931 three or four hundred birds were seen to have collected and this number was not exceeded that season. All the birds again left 31-1-1931, when the lagoons almost dried, but returned once again in much smaller numbers about 16-2-1931. Only about fifty birds remained on 10-3-1931 and these left shortly after.

'When these flamingoes leave the island they usually fly north and spend some days near Mandapam Camp and are finally seen in fairly large numbers on a tank at Ramnad.' Mr. Biddulph's record is interesting as it gives some definite information as to the arrival and departure of flamingoes in Ramesvaram Island. The birds arrived in November, soon after the breeding season in the Rann and left in March, two months before the Spanish and four months before the Indian breeding season.

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[1] 'Birds of Rameswaram Island,' *J.B.N.H.S.*, xl, p. 256.

That flamingoes migrate to the African continent is amply supported by several observers, but the breeding records are scarce. Layard states that Mr. Chapman informed him 'that both Flamingos found in South Africa breed on Lake N'gami.' Young flamingoes in immature plumage have been killed at the mouth of the Salt River, close to Cape Town. According to Sclates they breed in Cape Verde Island.

THE MUSEUM EXPEDITION.

The success of the museum expedition depended on the discovery of an active breeding colony. Scouts had to keep an eye open for such colonies and on discovery a telegram was to be sent to us to start. This part of the work was undertaken by Captain Steer-Webster. It was no easy matter under the conditions described—it meant hard and persistent work. Weeks passed without definite news, and we were about to give up all hope for that year (1935) when, at last, the long-awaited telegram arrived. The expedition left Bombay the same night. In any case, it meant almost a week's delay, owing to the time lost in getting to the spot. Much can happen in a week when nesting birds are concerned.

The party from Bombay consisted of an artist, Mr. H. N. Wandrekar, to make sketches of the landscape, a modeller, Mr. G. Nogeira for preparing the accessories and myself, whose task was to ensure the success of the efforts and act as a stopgap. All necessary arrangements had been made with the Jamnagar State for a rapid passage through to Khandla. We were transported on the night of our arrival to Rosi Bunder; after scrambling over piers under construction and oyster-covered, slippery rocks, a small boat brought us on board the ferry. We slept well that night, only to learn next morning that there was no prospect of a breakfast. However, that was a minor evil. At last we managed to find a cup of tea—it kept us from absolute starvation! At dawn we weighed anchor and at about midday reached Khandla, a promising port.

At Khandla we were to meet Captain Webster, but when we disembarked, after a few hours sail up the Gulf of Cutch, there was no Webster. His clerk, Mr. Chunilal greeted us with the news that Capt. Webster would probably not be able to accompany us into the Rann owing to serious sunburns. Before leaving Khandla, one of the Customs Officers gave us a meal which was welcome indeed. After breakfast we bid adieu to our kind host and set out for Bhuj, forty miles away. We sped along on an elevated road between acres of mud flats, then through a semi-desert type of vegetation. We passed through the walled town of Anjar and eventually reached Bhuj in the afternoon. On arrival at Captain Webster's bungalow we realised, and fully understood why he was unable to meet us. His condition was self-explanatory. His face was red, swollen, cracked and pealing in several places, his arms were not much better—he was a picture of misery. The blazing sun that beats over the Rann had got the better of him. He had been out to the Rann himself to make certain of the site before telegraphing to us. He had been many hours in the saddle in the inhospitable country where there is no shade of any sort, but miles of glittering water. On the outward journey he was compelled to ride into the east, in the face of the sun, and on the return into the west! Only those who have experienced the Rann can appreciate the dreadfulness of the conditions at such a time. He very gamely suggested that if he could have another day's rest he would accompany us. To this we readily agreed. So another day was pleasantly lost in Bhuj.

In the meantime, advance parties had gone ahead to prepare the camps, one at Kawra and one at Nir Wand on the very edge of the Great Rann, fifteen miles away from the actual site. According to programme we set out the following morning in two motor cars, loaded to their utmost with human and material cargo.

Before leaving Bhuj we picked up the Khan Sahib of Pachum Island, a well built gentleman with a dense villous growth covering a goodly portion of his face, and a determined countenance. At his side dangled a sword in a silver scabbard, the straps ornamented with silver coins—he was an imposing figure. He was to be our guardian and guide while in his territory. The road, a few miles out of Bhuj, led to a cart track; this we followed winding our way through clumps of bushes and babul trees till we reached the Bhunny—a flat expanse of many miles showing traces of recent inundation. The trees gave place to a vegetation strongly reminiscent of a maritime formation—it was a drying salt marsh. The only incident that interrupted our rapid progress towards Kawra, our first camp, was the sight of a saw-scaled Viper (*Echis carinata*) up a tree. It was a large specimen and was soon brought to bag, much to the discomfort of the occupants of the back seat! After about fifty miles, we reached Kawra. There, just outside the village, was our camp of several tents, horses and camels. It was the most luxurious camp the author ever occupied on a natural history trip. There were hot baths awaiting us, and almost every other amenity one can enjoy in a comfortable house in a city. We left the cars at Kawra and started the next morning for Nir Wand on horses and camels.

As we had thirty-five miles to go, the camp was astir at dawn so as to cover the distance before the merciless sun got too hot. Captain Webster led the way on horseback. Not being a horseman I preferred the 'Ship of the Desert', an old acquaintance. The artist and the modeller followed my example. The track led through undulating country for a while, then along the foot of the Pachum hills bordering the Rann and finally through part of the Rann itself, which in places was still treacherous for the camels. There were several patches which clearly showed where camels had been in great difficulties. When we got into the Rann mirages began to play tricks—forests, hills, and flamingo colonies appeared where there were none. Sheets of water with flamingoes were mirrored here and there; all to disappear or reappear in some other quarter after a few hundred yards. They were just phantoms that appeared and disappeared like changing scenes on a great stage!

Shortly after noon, after rounding the spur of a hill that comes down to the Rann, we reached Nir Wand, our base camp. The animals sighted the camp and immediately quickened their pace—it smelt like home and a rest! We were as glad as the animals.

This camp, as comfortable as the last, was at the foot of the hills bordering the Great Rann. We soon settled down and made preparations for the assault on the flamingo 'city 'the next morning. From now on, it was to be all horses as the camels could not possibly negotiate the slush in the Rann. For safety sake, much against my will, I tried out some of the quieter looking horses. There was no alternative; walking thirty miles a day and that through slush was out of the question. The lady of my choice—the horses were the only ladies in the camp—proved her looks.

As the background of the case was to illustrate sunrise, it meant we had to be astir *early*. Early rising requires early bed! At 2 a.m. the camp was alive and after a hearty breakfast we were in the saddle by 3 a.m. The cavalcade set out, at first, in single file, then by twos and threes abreast. The artist and the modeller, for reasons best known to themselves, selected two Cutchi ponies instead of horses. There was no moon, but the stars shone brightly. After picking our way through the vegetation surrounding the camp, mostly *Salvadora persica* and Babul (*Acacia arabica*), we entered the Rann. The light coloured sand and crystallized salt showed up clearly; the surface was only broken by the hoof-marks left by Captain Webster's party, on his eventful visit—we followed them as a guide to the spot. In the dark, without the oppressing heat of the day, we soon covered the distance to the accompaniment of a lively conversation and the *slosh, slosh* of the many hoofs. We arrived at the 'city' just as the eastern sky began to show a faint glow. To our amazement and utter disappointment there was not a flamingo to be seen, nor was there any water in the neighbourhood. No one was more sore than Captain Webster, who only a week previous had visited the spot and seen the flamingoes there. The old tracks indicated clearly that we had not strayed. Though sorely disappointed, a museum man can always make the best of a bad job, if he has the will to. He can truthfully reproduce a scene from the remnants, or can even create a new species by dexterous manipulation. We dismounted and the artist and the modeller got ready the material to commence work. While Captain Webster and I discussed the situation the sun peeped above the horizon and a few seconds later presented an ugly shape through a haze. Across the face of the sun stretched a thin line of cloud as though to hide its ungainly shape. Another few seconds and the shape was lost in brilliancy.

Now that it was light, we surveyed the country but nothing could be seen, except in the dim distance, many miles away, a line of white and pink—adult flamingoes! Hurrah, there they are! Then suddenly something moved in the lifeless plain before us, was it a flamingo chick? It was. There was no one faster into the saddle than myself, and quicker away. I had forgotten all about horses and horsemanship, I was only intent on the forlorn orphan.

Such a heap of ill dressed humanity, clinging to the saddle with every appendage, flying along a slippery surface, is difficult to describe. I was even oblivious of the roar of laughter that went up as I sped along. I hadn't hands enough to hold the horse and other flying articles that dangled from my shoulders, and now threatened to part company! The first of these was my hat, but regardless I hurried on. I soon came up with the object of my pursuit; it dodged here and there, but eventually it was brought to bag. By this time, the mare (a knowing animal), seemed to enter of her own accord into the sport. As soon as I was back in the saddle, she made off in another direction at a tremendous pace—much to my embarrassment. No amount of reining had any effect. She had spied another chick and just made for it. By this time I had had about enough of riding, so I remained dismounted till the others came to my assistance. The lost possessions were returned, and I decided to go about soberly with the rest in future, in fact, my condition retarded the speed of the whole company for the rest of the journey.

These stray chicks are undoubtedly weaklings not able to keep up with the main body on the northward march. Later we found many more of these wanderers of different ages. Having secured these chicks we now set out in the direction of the adults, but the line vanished—it was a mirage, nevertheless, we kept on and eventually came up with the receding water. In the past week it had receded nearly three miles from the nests! Here we also discovered thousands of young flamingoes with a few adult guardians. Our spirits rose high, we now knew where to find them. The adults were extremely shy and kept well out of range, but a lucky shot brought one to earth as it rose into the sky. Adult birds together were not seen in the Rann at this time. We now returned to the nesting site.

During our absence the artist had commenced on his preliminary sketch and the modeller was busy making a mould of one of the nests. A small tent was pitched for storing the materials during our absence from the site. It was now nearly 9 a.m., time to turn our horses' heads campwards; it was becoming exceedingly hot. No sooner were we mounted than the horses broke into a lively pace—too lively, in fact, for me, my back ached in every bone. I continually made mental resolution never to ride again! It was two and a half hours ride home, in a temperature continually rising, and miles of waste on all sides—no distractions, but mirages. The start of the homeward journey was usually good, problems were discussed, but soon everyone kept his own counsel, except now and again when there was a general laugh at the artist and modeller having a race on their respective ponies. When this amusement ceased, all relapsed into silence once more. The only sound that broke the still, hot air was that of the horses' hoofs as the animals ploughed through the slush. Either from want of good sleep or due to the atmosphere and the monotony of the journey, I could never keep my eyes opened for long, and would gradually fall into a deep doze, only to be awakened by a sudden acute ache in the spine which indicated an increase in speed. On comparing notes I was not the only slumberer on horseback, some others were guilty too!

On arrival in camp a bath and a sumptuous lunch awaited us. After lunch a short rest was indicated and the necessity for the labours of the *champiwallas* (massage experts). They pummled our aching bodies for a while before we fell asleep. After this respite, work on the specimens commenced. For some unknown reason the artist refused the attentions of the *champiwallas* the first afternoon, but to our surprise the next day he was among the first requiring their aid—but this he did very secretly. The laugh was the greater!

Our camp was situated in the midst of a colony of Desert Gerbils (*Chelones hurrianae*). Lying in bed of an afternoon it was easy to watch the activities of these little creatures as they popped in and out of their burrows—the place was riddled with holes and mounds of excavated sand. They would first peep out, have a look round, and if the coast was clear, sit at the entrance on their hind limbs, with their long whiskers scintillating in the sun. On the slightest sound they would dart in again. Together with the adults were several half-grown young. One female shot was gravid. On the sand, little sand lizards scuttled about and on approach often sought refuge in one of the burrows. At nightfall, out of the same burrows (disused?) came toads (*Bufo andersoni*) and tenebrionid beetles all apparently living together on good terms! Possibly the frequent visits of the Saw-scaled Viper (*Echis carinata*), which caused much distraction in the camp, were also from the same burrows (?). The camp was alive with desert forms, yet a few hundred yards further not a living thing stirred in the Great Rann, except flamingoes—and those were miles away.

Day after day this was a routine for ten days. However, one morning our exit from camp was marked by a humorous incident. As we wended our way through the bushes in the dark, there was a sudden flow of *good* Mahrati from a little way off! As the artist was the only one capable of such a feat in a *Cutchi* speaking country, something must have happened for this outburst of invective. We soon discovered the reason for it. In the darkness the artist's pony took the wrong track and tried going under a babul tree and so landed the artist in a bed of thorns!—no wonder the language! A babul is at all times to be respected, but in the dark it is a devil incarnate. Luckily the incident passed without serious consequences and we continued our journey—the artist silently cursing the ancestry of his animal. Another incident of note occurred on the day before we left Nir Wand. We awoke in the morning to find that one of our mares had given birth to a healthy colt. This animal had been ridden all the while—the groom had miscalculated her time by months. It was a surprise for no one expected it. The same evening the colt was put on a cart *en route* for Bhuj, his mother following behind.

The regularity of our daily visits to the site was only broken on two occasions owing to the difficulty of getting adult flamingoes, so Captain Webster and I decided on night attacks. As it was quite an easy matter to lose our way on the desert in the dark, some men were sent out with a lantern and a pole—a lighthouse in 'flamingo land'. At dusk we would set out and wend our way to the 'light house'. From this point we followed our ears to where we could hear the flamingoes, only the deep 'honks' interested us. We were now on foot, often wading knee-deep in water, with soft treacherous sand underfoot. The electric torches showed the young birds running in all directions, but it was no easy matter to locate the sentinel adult. In the light, the young birds got quite confused and were easy to catch—they would often rush into the beam and come between our legs. Two nights of this was enough—it meant wading for hours. The temperature dropped considerably at night, it was not cold, but the continuous wetting chilled our bodies a good bit. In this way we added two more adults to the collection.

On completing our work in the Rann we turned our horses' heads homewards. In spite of my 'broken' back I was sorry to leave—the time was only occupied with one job—flamingoes, but besides flamingoes there were so many things of great interest, both botanical and zoological—a meeting ground of the absolute and semi-desert fauna and flora. What made our stay all the more enjoyable was the generous hospitality we received at the hands of the State—we thank them most cordially. Back at Kawra we tried to secure some more adults on a marsh near by, but failed, owing to the impossibility of getting near the birds. That evening we had a particularly heavy, local storm over the area and were forced to make a hurried retreat, for fear of the cars being bogged in the treacherous ground. From Kawra it was but a morning's drive back to Bhuj. In spite of the many difficulties we were all in good spirits. Before leaving Cutch we paid our respects to Maharaj Kumar Sahib Vijiaraji at Mandvi. At the same time we managed to add three more adults to the collection. We said good-bye to Cutch and boarded the steamer at Mandvi for home —*Auf wiedersehen* !

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THE INDIAN CADDIS FLIES (*TRICHOPTERA*).

BY

MARTIN E. MOSELY, F.R.E.S., F.Z.S.

(*With twelve plates*).

PART VI.

(*Continued from page* 496 *of Volume* xl, 1938).

SERICOSTOMATIDAE (*Cont.*)

Thremminae Martynov.

Thremminae Mart., Trav. Inst. Zool. Ac. Sci., U.R.S.S., 12, pp. 386-387, 1933.

Ocelli present; maxillary palpi of the ♂ either one- two- or three-jointed; discoidal cell present in the anterior wing, absent in the posterior in the known Indian species. Insects generally blackish.

Only one genus, *Eothremma*, is at present known to occur in India.

The *Thremminae* is the only sub-family in the Sericostomatidae in which ocelli are present.

Eothremma Martynov.

Eothremma Mart., Annot. Zool. Japon., 14, p. 150, 1933.

Spurs 1, 3, 4; maxillary palpi ♂, single- or two-jointed, terminal joint sometimes obscure; in the wings, discoidal cell present in the anterior, absent in the posterior; genitalia ♂ with generally a pair of oval superior appendages and a wide ventral plate bearing numerous,upturned teeth;

Genotype: *Eothremma japonica* Mart.

Eothremma parva sp. n. Pl. 1. Figs. 1-5.

Insect small and black. Maxillary palpi ♂, single-jointed, the joint being exceptionally short.

Genitalia ♂.—Superior appendages very large, clavate at their apices; ninth tergite, from above, obsolete; in the cavity is a pair of downwardly directed processes, possibly strongly chitinized productions of the lateral angles of a membranous dorsal plate; the apices of these processes are slightly inturned; between them is a forked process, the forks appearing as plates set edgewise; penis short, slender and rod-like; ventral plate rectangular, armed with short, peg-like teeth.

Length of the anterior wing ♂ 8 mm.

N.-E. Burma: Kambaiti, 6,800 ft., 9-iv-1934. R. Malaise.

Type ♂ in the collection of the Stockholm Museum. A ♂ paratype in the British Museum collection.

Eothremma burmana sp. n. Pl. 2. Figs. 1-8. Pl. 3. Figs. 1-3.

Insect dark walnut-brown; anterior wing with a broad, short discoidal cell; maxillary palpi in the ♂ varying in form in individuals, one- or two-jointed, basal joint large and dilated, terminal joint slender, sometimes very inconspicuous and scarcely to be made out in the dried examples; in the ♀, the maxillary palpi are unusually short, measuring only 0.86 mm. against a width of head and oculi of 1.46 mm.; only two ocelli present.

Genitalia ♂.—The ninth tergite from above, slightly depressed and produced in a pair of broad plates, somewhat penthouse in shape with the upper edges slightly overlapping; superior appendages very large, rounded at their apices and slightly constricted at their bases; the other parts of the genitalia are obscure; penis slender accompanied by a pair of sinuous and strongly chitinized sheaths; ventral plate rectangular, armed with short teeth along its apical margin.

Genitalia ♀.—The abdomen terminates in a triangular dorsal plate. There is a large vulvar scale of which the middle lobe is broad and the side lobes terminate in acute points; above the scale is a plate which is excised at the centre of its apical margin.

Length of the anterior wing ♂ 10 mm.; ♀ 12 mm.

N.-E. Burma: Kambaiti, iv-vi-1934, R. Malaise.

Type ♂ in the collection of the Stockholm Museum. Numerous paratypes ♂ and ♀ in the collections of the Stockholm and British Museums.

This species presents the very unusual character of a varying number of joints to the male maxillary palpus. In some examples there are very definitely two though the second may be reduced to a mere tubercle. In others, there is a single, cylindrical joint. The neuration is also subject to variation, fork no. 3 having a short footstalk in some examples and being sessile in others. I have been unable to find a sufficient variation in the form of the genitalia to warrant the erection of separate species but figures of the wings and palpi from additional examples are here shown.

Eothremma hindustana Martynov. Pl. 3. Fig. 4.

Eothremma hindustana Mart., Rec. Ind. Mus., 38, pp. 296-7, Fig. 69, 1936.

Martynov describes the species as follows:—

'Head blackish-brown, with distinct ocelli, behind which and the eyes are seen pale yellow stripes. Basal joint of the antennae brownish, second very short, next two joints elongated, yellow. Thorax dark brown, portion of membrane uniting separate sclerites, pale; coxae brown, legs brownish-yellow. Anterior wing pale brownish, with brownish venation; venation resembling that of *Eothremma japonica* Mart., but discoidal and thyridial cells are longer, fork 3 pedicillate and CuA in its end portion is dark towards M_3. In posterior wings, M divides a little earlier than the division of Rs, crossvein rs-m longer, fork 5 is very short in *E. hindustana*; abdomen brown, but three posterior segments yellow above.

'Length of body 5.5 mm.

'Remarks.—Judging by the wing venation, *E. hindustana* is evidently similar and allied to *E. japonica* Mart. from Japan. *Thremminae* is a relict sub-family with few genera and species; its representatives are very rare; therefore the discovery in North India of the second species of *Eothremma* is very interesting; similar geographical distribution is met with in the genus *Limnocentropus* Ulm. (*Phryganeidae*).

'♀ Punjab, Punj-pul Nullah, about a couple of miles from Dalhousie-Bakloh Road, 6,500 ft., v.27, S. L. Hora.'

Type ♀ in the Calcutta Museum.

Eothremma laga sp. n. Pl. 4. Figs. 1-7.

The examples before me were both collected in fluid and subsequently mounted in balsam; I am unable, in consequence, to give any indication as to the general appearance of this insect. Antennae, basal joint, about as long as the breadth of the head, next joint not much more than half the length of each of the following joints; maxillary palpi with a microscopic terminal joint; labial palpi very long; both wings have a narrow, yellow, chitinized groove at the base between the subcosta and the base of the radius which, in both wings, is somewhat thickened; in the anterior wing, fork no. 1 very narrow, with a short footstalk.

Genitalia ♂.—Margin of the ninth tergite straight; projecting beyond it is a slender, arching process with a narrow stem and bifid apex which is dilated both from above and the side; this may be the upper portion of an upper penis-cover; superior appendages strong, caliper-shaped, somewhat dilated at the apices as seen from the side; the lower portion of the upper penis-cover is in the form of a pair of wide, blackened, down-curved hooks; penis narrow and sinuous, only visible in a cleared example; inferior appendages very small and round; there is a wide, shallow, rectangular ventral plate with a strongly fringed and shallowly excised apical margin, with the inner surface set with short, peg-like spines.

Length of the anterior wing ♂ 5 mm.

Kashmir: Gagabal. 12,000 ft. F. J. Mitchell.

Type ♂ and paratype ♂ in the author's collection.

Eothremma punja sp. n. Pl. 5. Figs. 1-5.

The type and paratype of this species are both preserved in balsam so that a description of the general appearance of the insect is not possible.

Ocelli present; maxillary palpi single-jointed, the joint broader at its base than at its apex, carrying on its upper surface a mass of very stiff bristles; labial palpi, joints nearly equal in length, middle joint the shortest of the three; wings; the balsam in which the insects are mounted has rendered the neuration very indistinct, particularly in the posterior wing where it is too obscure for figuring.

Genitalia ♂.—The ninth dorsal segment is widely excised at its apical margin and there is a raised upper part, also with an excised margin and with the lateral apical angles slightly produced to form outstanding spurs; set in the centre of the excision is a pair of broad, vertical plates with much blackened apices; on each side of these plates is a stout superior appendage, broad and incurving from above and with a rounded, dilated apex from the side; penis somewhat bulbose at the base, narrowing to a rod-like apical part; from beneath, there is a somewhat rectangular ventral plate, the upper surface set with short stout spines, apex widely excised; inferior appendages very small and narrow, lying along the ventral margin of the ninth segment and directed inwards; ninth segment slightly produced at its centre.

Length of anterior wing ♂ 4.5 mm.

India: Punjab, Chotah, Bagahal, trib. R. Uhl. G. C. L. Howell.

Type and paratype ♂ in the author's collection.

Helicopsychinae Ulmer.

Helicopsychinae Ulmer, Bernstein, Beitr. Naturk. Preussen, 10, p. 304, 1912.

Spurs 1, 2, 2, or 1, 2, 4, or 2, 2, 4. Ocelli absent; maxillary palpi of the ♂ two- or three-jointed; basal joint, where three are present, very small; wings long and narrow, densely pubescent; in the anterior, discoidal cell present; posterior, forks nos. 4 and 5 generally present; discoidal cell wanting.

Only one genus, *Helicopsyche*, has been found as yet in India.

Helicopsyche Hagen.

Helicopsyche Hagen, Ent. Mon. Mag., 2, pp. 252-3, 1866.
McLach., Rev. & Syn. Trich., pp. 268-9, 1876.

Spurs 1, 2, 4 or 2, 2, 4. Antennae with the basal joints stout and with a pair of rounded, hinged plates between them at their junction with the head; maxillary palpi ♂, two-jointed, joints about equal in length; wings narrow, acute at their apices; neuration differing according to species; in the posterior wing, fork no. 4 generally present; costal margin bearing a row of small hooks; genitalia ♂, dorsal plate large; inferior appendages large, dilated and directed upwards; in both sexes, there is a ventral process to the sixth segment; the third, fourth, fifth, sometimes only the third and fourth sternites reticulated on their surfaces.

Genotype: *Helicopsyche borealis* Hagen.

I am unable to find the second and minute spur mentioned by McLachlan as pertaining to the anterior leg. In the Indian species here described, microscope preparations indicate that there is only one; the preparations also show that the ventral process is situated on the sixth and not on the seventh sternite as stated in McLachlan's Revisional Monograph. I cannot find, moreover, more than two joints in the ♂ maxillary palpi as against three, stated by McLachlan to be present in the European species.

The larvae of species in the genus are remarkable for their spiral and heliciform cases, constructed of sand and small stones. These were at first considered to be the shells of small fresh-water *Mollusca* and it was only in 1843 that their Trichopterous nature was first suspected.

Helicopsyche ceylanica Brauer.

Helicopsyche ceylanica Brauer, Reise Novara, Neur., p. 26, 1866.

Brauer's description is confined to an account of the larva and case. There is no mention of the adult form.

Helicopsyche minuta sp. n. Pl. 6. Figs. 1-7.

Insect small, wings clothed with widely separated, coarse hairs. In the ♂, anterior wing narrow and acute, with the discoidal cell doubtfully closed; posterior wing narrower than the anterior, with a very acute apex; spurs 1, 2, 4.

Genitalia ♂.—Dorsal plate large, widely cleft at its truncate apex, lateral angles produced in short spurs; a pair of short, slender appendages arising from the sides at the base; from the side, the dorsal plate is stout, arching downward; penis large and membranous with a pair of slender sheaths; inferior appendages very large and black; from the side, with slightly dilated apex, a short spur arising on the lower margin near the base; from beneath, inner margin serrate; there is a pair of long, slender branches arising from the base of the appendages between the two, apices slightly divergent; ventral process very small.

Genitalia ♀.—From above, there is a pair of raised, triangular ridges, narrowing to sub-acute, blackened apices; beneath is a rounded plate with a small excision at the centre of the apical margin; a small process to the sixth sternite.

Length of the anterior wing ♂ 4 mm.; ♀ 4.5 mm.

N.-E. Burma: Kambaiti, 30-iv-1934.

Type ♂ in the collection of the Stockholm Museum; paratypes ♂ and ♀ in the Stockholm and British Museum collections.

Helicopsyche martynovi sp. n. Pl. 7. Figs. 1-5.

Insect small, yellowish. Neuration towards the base of the posterior wing, irregular, with no apparent fork no. 5; spurs 1, 2, 4.

Genitalia ♂.—Ninth tergite produced in a long, rectangular plate with a deeply excised apex, each lateral angle bearing a pair of bristles; there is also a bristle on the upper surface on each side of the excision; at the base, on each side, is a slender appendage, seen from above, and with a clavate apex from the side; penis concealed, no apparent sheaths; inferior appendages claw-shaped with an excision on the lower margin towards the apex as seen from the side; from beneath, the lower margin overlaps the upper to make a fold in which is seen a pair of small processes, each armed at its apex with a bristle; a strong process to the sixth sternite.

Genitalia ♀.—The apex of the abdomen from above, terminates in a pair of parallel, finger-like processes, widely separated, with the surface of the tergite on each side strongly reticulated.

Length of the anterior wing ♂ 4 mm.; ♀ 5.5 mm.

Tenasserim: Mekane, 90km. East of Moulmein, 200 m. 2-8-xi-1934, R. Malaise.

Type ♂ in the Stockholm Museum collection. ♂ and ♀ paratype in the British Museum collection.

I dedicate this species to the memory of the late A. B. Martynov whose recent papers on the Trichoptera in the Calcutta Museum are of the greatest value and are outstanding examples of careful work.

Helicopsyche maculata sp. n. Pl. 8. Figs. 1-5.

This is a small, dark insect with narrow, brown wings, the anterior bearing a pale spot on its lower margin near the arculus; no apparent fork no. 5 to the posterior; head and thorax very dark brown; antennae dark brown, basal joint about the same length as a joint of the maxillary palpi, second joint small, remaining joints longer than the second; a small, rounded lobe arising from the head near the attachment of the basal joint on the inner side; ocelli wanting; maxillary palpi two-jointed, joints about the same length labial palpi three-jointed, all the joints short and approximately equal in length; spurs 1, 2, 4; tarsi and tibiae of the median, and tarsi only of the posterior legs bearing short, black spines.

Genitalia ♂.—Ninth tergite produced in a long, rectangular plate with an excised apical margin, the excision beginning at the apical angles so that a pair of triangular forks is formed; beneath this is a membranous penis with a pair of long, fine, caliper-shaped sheaths; inferior appendages furcate, basal fork short, situated ventrally, triangular from beneath with a produced apex, directed distally; second fork large, directed upward from the side, apex curving distally, outer margin produced towards its centre in an irregularly shaped mass; the lateral angles of the ninth segment are produced in small, irregular knobs; a large process to the sixth ventral segment.

Length of the anterior wing ♂ 4.5 mm.

Palnis: 7,000 ft. Kodaikanal Shola, 16-viii-1921, Fletcher Coll.

Type ♂ in the collection of the British Museum.

Helicopsyche shaunga sp. n. Pl. 9. Figs. 1-5.

Insect small and yellowish; basal joint of the antenna about half the width of the head with the oculi; maxillary palpi two-jointed, basal joint broad and slightly curved, terminal joint very small; labial palpi three-jointed, basal joint long and broad, twice the length of the second, third joint microscopic; wings with the neuration abnormal or aberrant in the single example before me; apical forks nos. 1, 4 and 5 in the anterior, only 3 and 5 in the posterior. The species is thus exceptional in lacking fork no. 4 in the posterior wing. Spurs, 1, 2, 4.

Genitalia ♂.—Ninth tergite forming a long plate arising from a broad base and produced to a narrower, truncate apex, slightly excised at the centre of its apical margin; it bears a few short, stout bristles on its upper surface towards the apex; the appendages of the plate small, arising from narrow stems, apices clavate; from the side, situated midway and towards the margin of the segment; penis concealed; lower penis-cover broad, with an excised apex and perhaps bearing a ventral ridge at the base of which are two short, rod-like spurs, slightly diverging from each other; inferior appendiages large, apices clavate, arising from narrow stems, lower and inner margins set with short, peg-like teeth; the surface of the third, fourth and fifth sternites reticulated.

Length of the anterior wing ♂ 4 mm.

Burma, ca. 200m. Washaung, 20km. East of Myitkyina, 14-vii-1934, R. Malaise.

Type ♂ in the collection of the Stockholm Museum.

The following genera, *Ashmira, Gastrocentrides* and *Noleka* have not been placed in any of the established subfamilies. When further knowledge of the Indian Sericostomatidae has been obtained, new sub-families will doubtless indicate themselves along natural lines to take these genera.

Ashmira gen. nov.

Spurs, 2, 4, 3. Forks 1, 2, 3 and 5 present in both wings in both sexes; discoidal cell in anterior wing long and narrow, in the posterior, shorter and broader, particularly towards the distal end. Other details in the description of the single species *elia.*

Genotype: *Ashmira elia* sp. nov.

Ashmira elia sp. nov. Pl. 10. Figs. 1-9.

Head black; oculi bronze; antennae dark fuscous with very faintly indicated, slightly paler annulations; basal joint large with a short acute tongue arising at the apical margin to engage with a narrow excision of the second joint; this joint is very short, third joint more than twice the length of the second, other joints slightly longer than the second; palpi fuscous, maxillary with the basal joint shorter than the second, first and second joints globular, third small and slender, legs fuscous, spurs 2, 4, 3; wings dark fuscous with short, close, fuscous, nearly black pubescence.

Genitalia ♂.—Dorsal margin of the ninth segment widely excised; in the centre of the excision are the superior appendages, set very close together, slightly dilated before the sub-acute apices, and, in one example, with serrated lateral margins; beneath them is an upper penis-cover varying considerably in form in individuals; it is roughly triangular with a pair of strongly chitinised processes arising at the centre of its basal margin; in one example these processes are small, in another nearly as long as the triangular cover and with serrate or sinuous lateral margins; arising from beyond or between their apices is a pair of finger-like membranous processes projecting beyond the excised apex of the cover, each apical angle slightly produced and often there are small wart-like projections along the lateral margins; penis with a slender stem and furcate apex; inferior appendages branched; upper branch terminating in a rounded, membranous apex, seen from above; obliquely truncate from the side; below this branch is a strongly chitinised second branch, apex from above and beneath, acute and directed inwards, lower branch from beneath, very stout and also terminating in a membranous, rounded apex; from the side, there is a wide rounded excision between the upper and lower branches, the second branch long and somewhat rectangular, arising at the centre of the excision, directed tailward.

Genitalia ♀.—From above, the last segment terminates in two triangular plates which cover a membranous plate, the apex of which is turned slightly over; terminal ventral segment produced in a rectangular plate.

Length of anterior wing ♂ 7.5 mm.; ♀ 9 mm.

Kashmir: Arrah Riv., 4-v-1925, F. J. Mitchell; Gulmarg: 15-vi-1931, Fletcher Coll.

Type ♂, a microscope preparation, (Arrah Riv.) in the author's collection; paratypes ♂ and ♀ in the author's and the British Museum collections.

Gastrocentrides Ulmer.

Gastrocentrides Ulm., Treubia, xl, pp. 475-6, 1930.

According to Ulmer, the maxillary palpi ♂ should be three-jointed. His figure of the genotype, *sumatrana*, only indicates two joints and I am unable to find more than this number in the single species present amongst the Indian material. He also gives the spurs as 2, 4, 4 whereas, in the single Indian species they are unquestionably 1, 4, 4. Anterior wings with forks nos. 1, 2, 3 and 5, posterior nos. 1, 2 and 3; neuration alike in both sexes; ventral processes in both sexes to the sixth sternite.

Genotype: *G. sumatrana* Ulmer.

Gastrocentrides evansi sp. n. Pl. II. Figs. 1-5.

Insect small and yellowish. Maxillary palpi ♂ two-jointed, joints equal in length, the terminal with a branch arising towards the base, closely applied on the upper surface; labial palpi with a small basal joint, second twice as long, third, twice as long as the second.

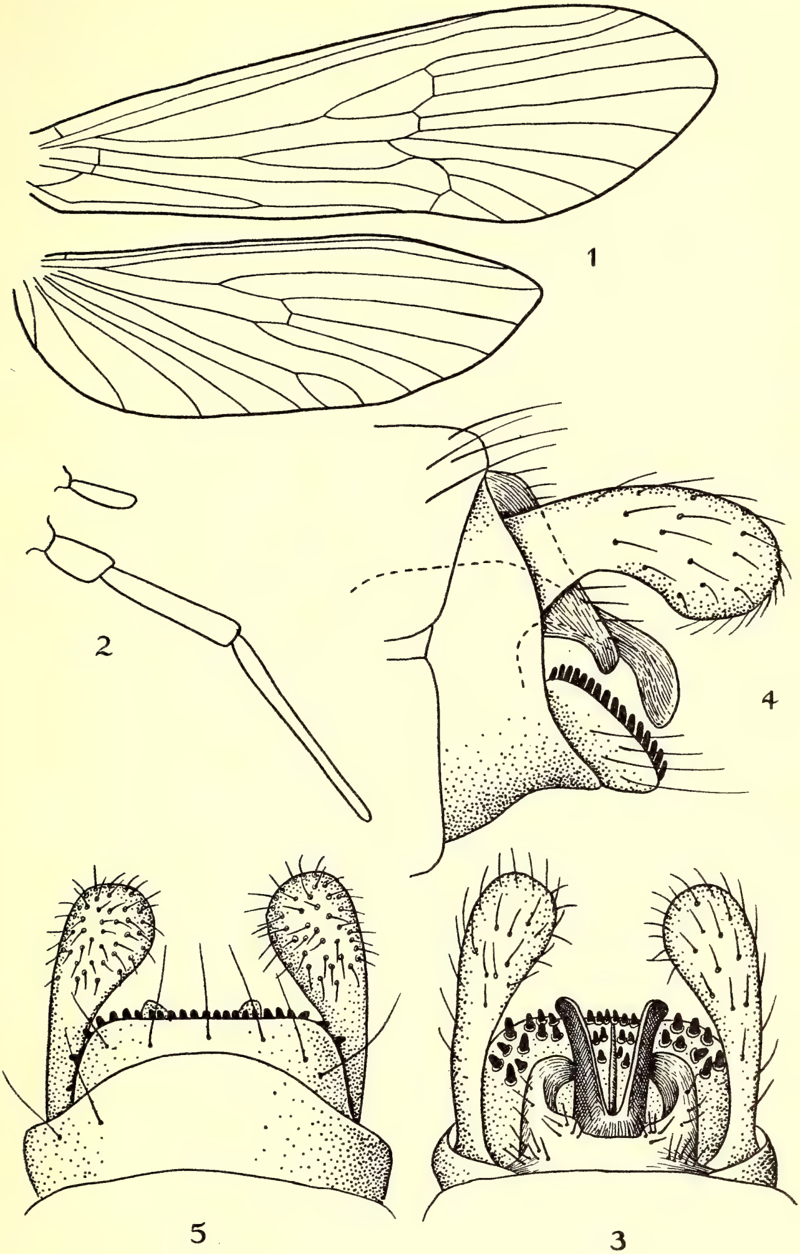
Genitalia ♂.—Superior appendages narrow from above, inclining slightly inwards, rounded from the side; dorsal plate very large, deep from the side; penis obscured by other parts of the genitalia; inferior appendages very broad, particularly from the side, with the apices turned outwards, lateral margins sinuous from beneath; apical margin of the ninth sternite produced at its centre to form a process when seen from the side; a very strong process to the sixth sternite.

♀.—The neuration will enable the ♀ to be easily recognised, differing in no great respect from that of the ♂. As in this sex, there is a process to the sixth sternite.

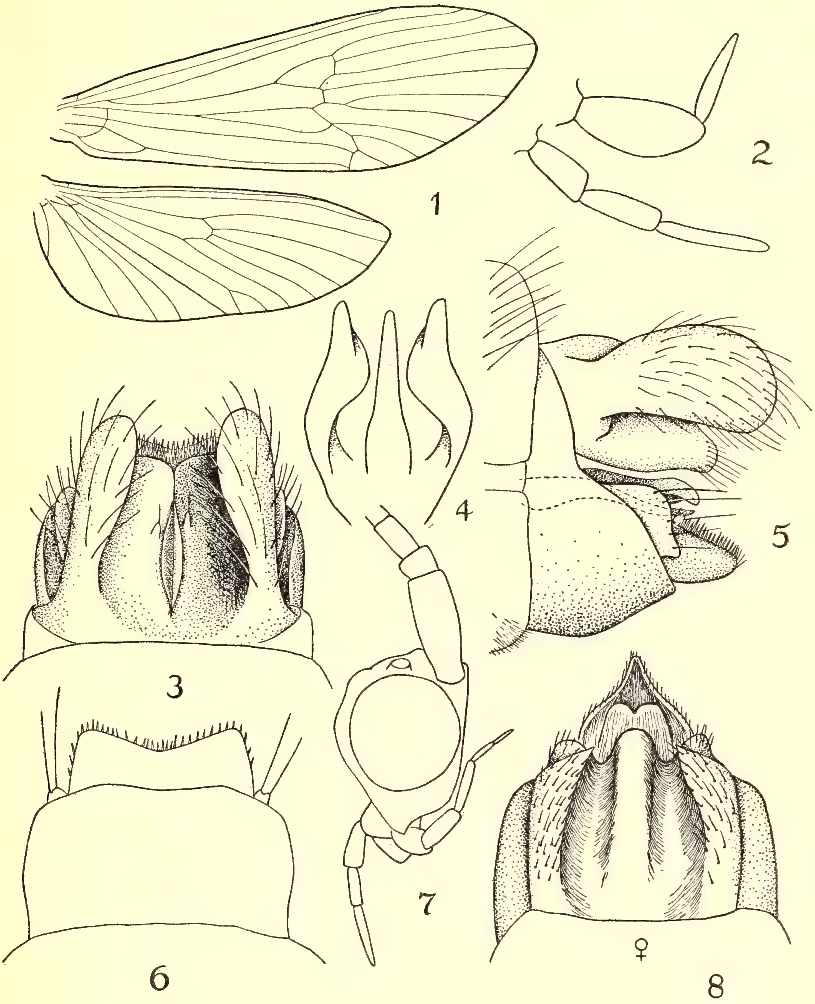
Length of the anterior wing ♂ 4 mm.; ♀ 6 mm.

N. Burma. Myitkyima, 175 m., 1-14-iii-1934; Washaung, 20km. East of Myitkyina, 16-iii-1934; 14-vii-1934, R. Malaise.

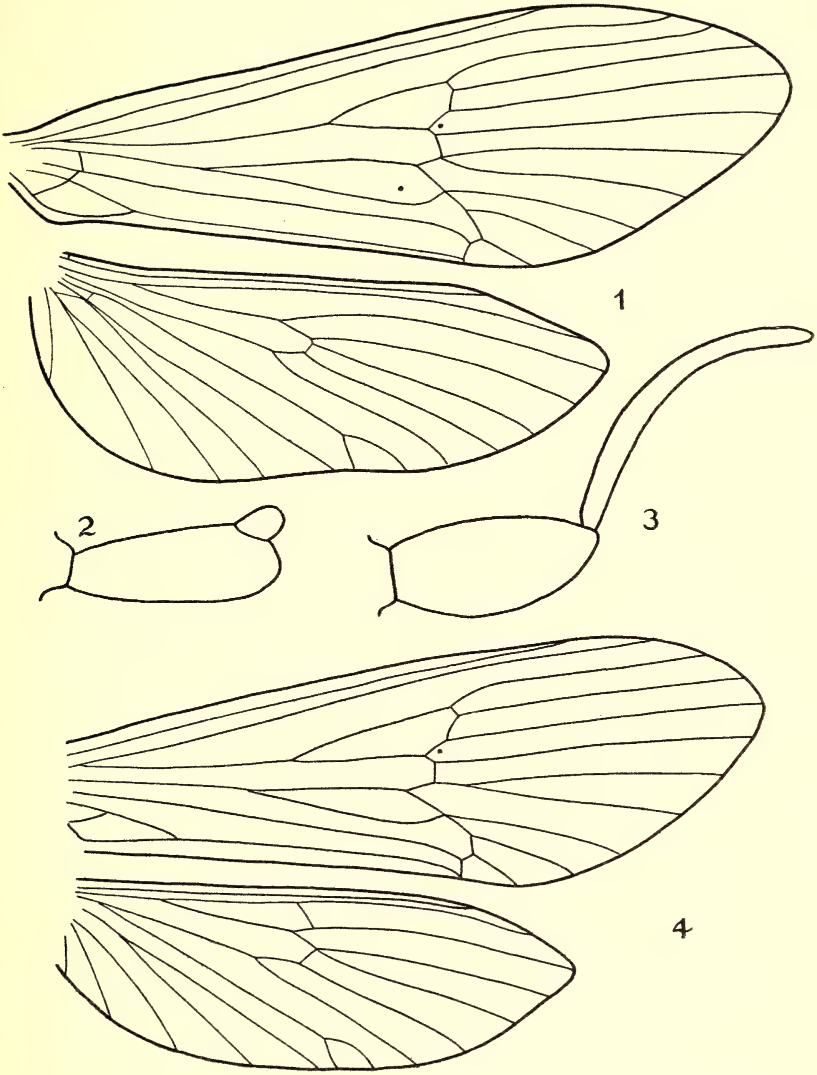
Type ♂ in the collection of the Stockholm Museum. Paratypes ♂ and ♀ in the Stockholm and the British Museum collections.



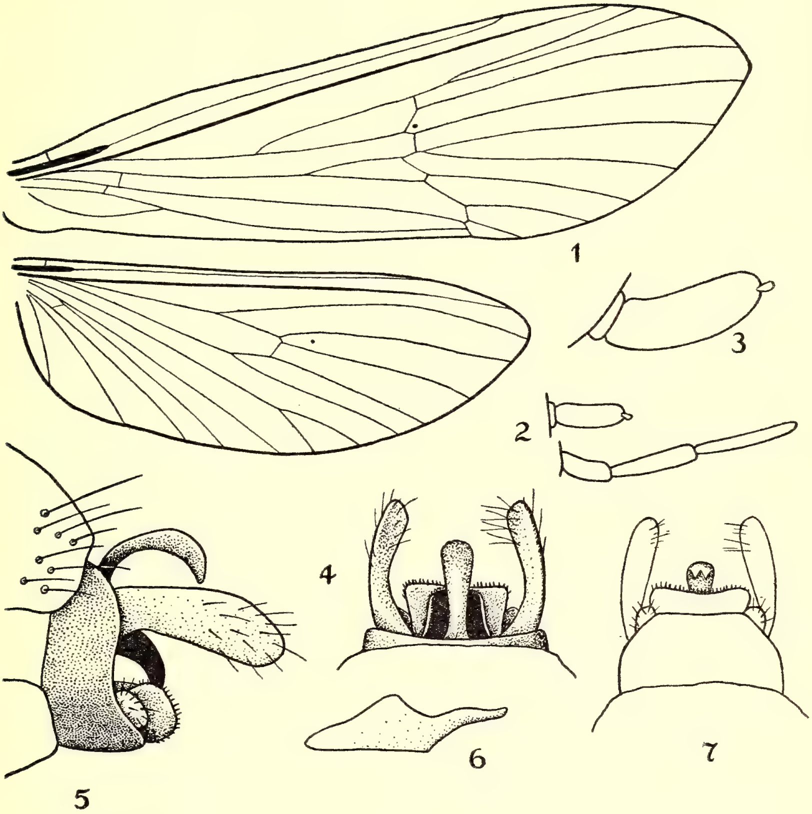
Eothremma parva sp. n., ♂.—Fig. 1, wings. Fig. 2, palpi. Fig. 3, genitalia, dorsal. Fig. 4, lateral. Fig. 5, ventral.



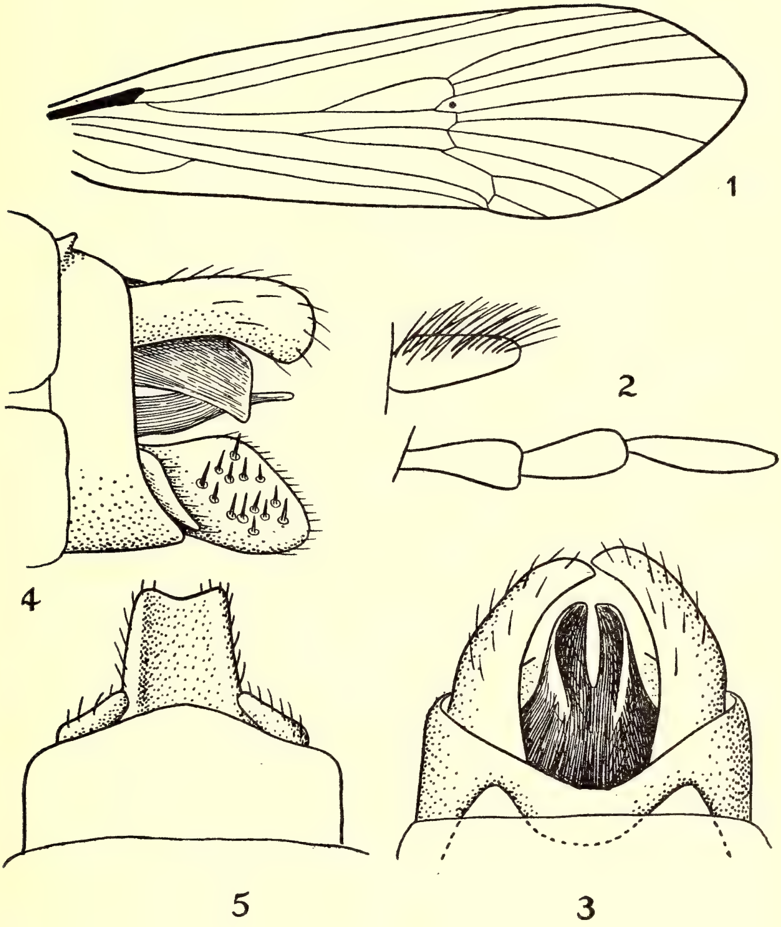
Eothremma burmana sp. n.—Fig. 1, wings ♂. Fig. 2, palpi ♂. Fig. 3, genitalia ♂, dorsal. Fig. 4, penis and sheaths, dorsal. Fig. 5, genitalia ♂, lateral. Fig. 6, ventral. Fig. 7, head of ♀. Fig. 8, apex of the abdomen ♀, ventral.



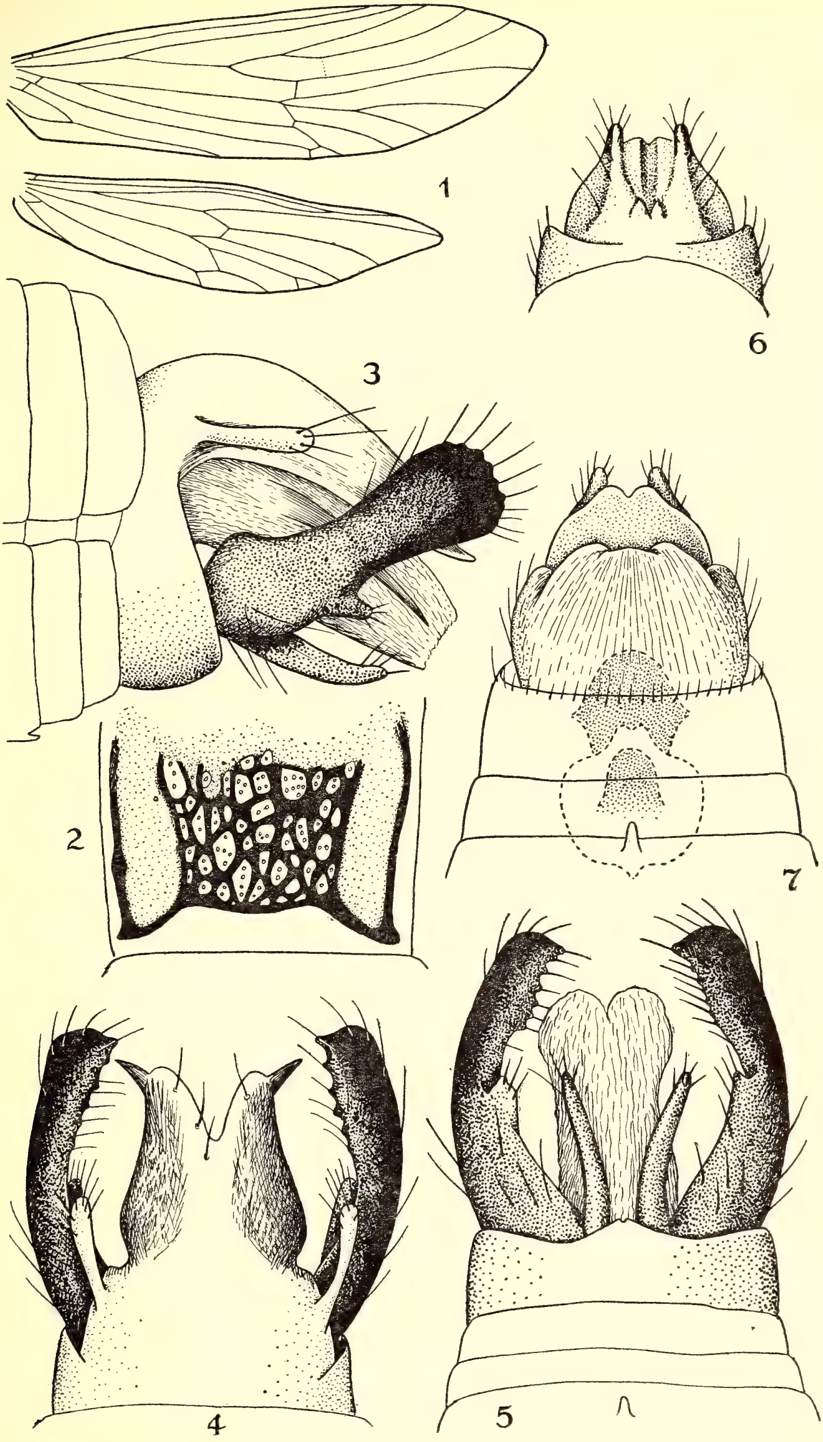
Eothremma burmana sp. n., ♂.—Another example. Fig. 1, wings. Fig. 2, maxillary palpus. Fig. 3, maxillary palpus from a third example. *Eothremma hindustana* Mart., ♀.—Fig. 4, wings (after Martynov).



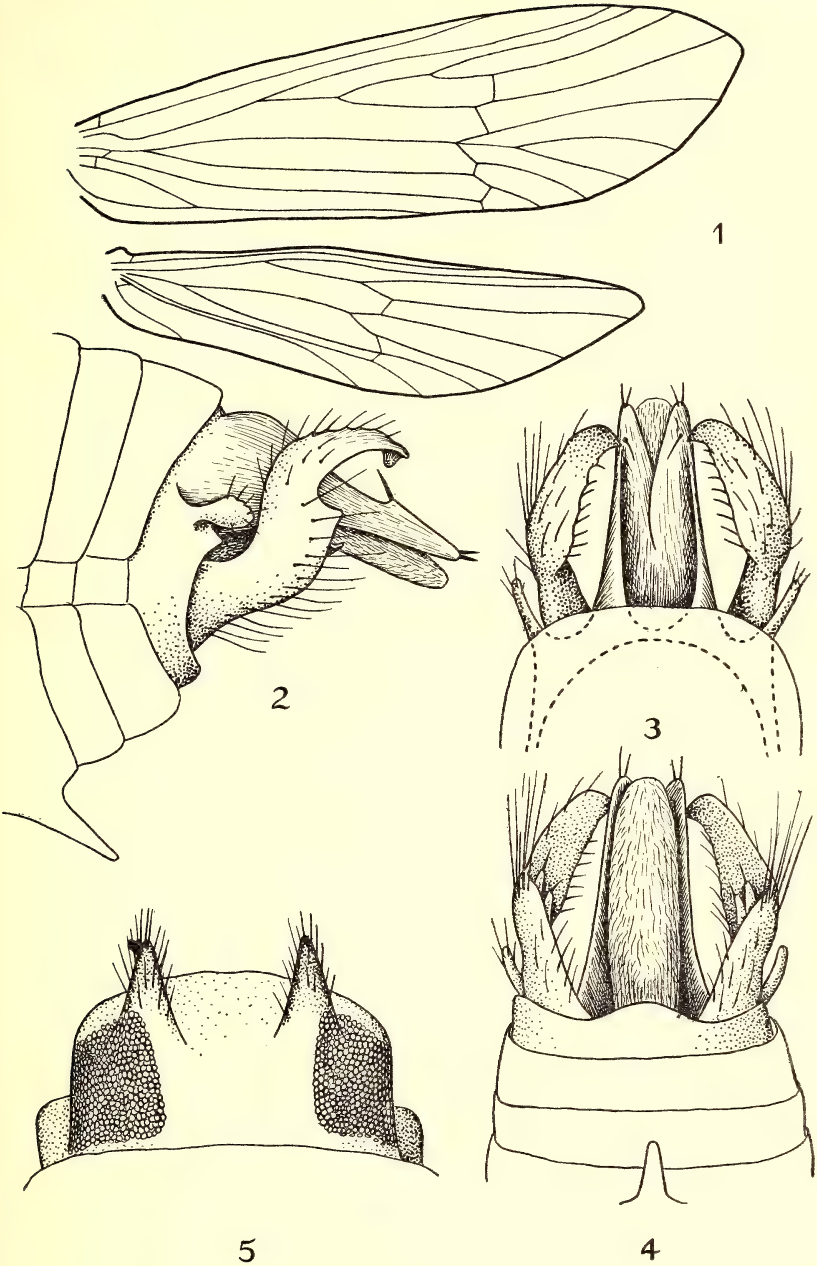
Eothremma laga sp. n., ♂.—Fig. 1, wings. Fig. 2, palpi. Fig. 3, maxillary palpus, more enlarged. Fig. 4, genitalia, dorsal. Fig. 5, lateral. Fig. 6, penis, lateral. Fig. 7, genitalia, ventral.



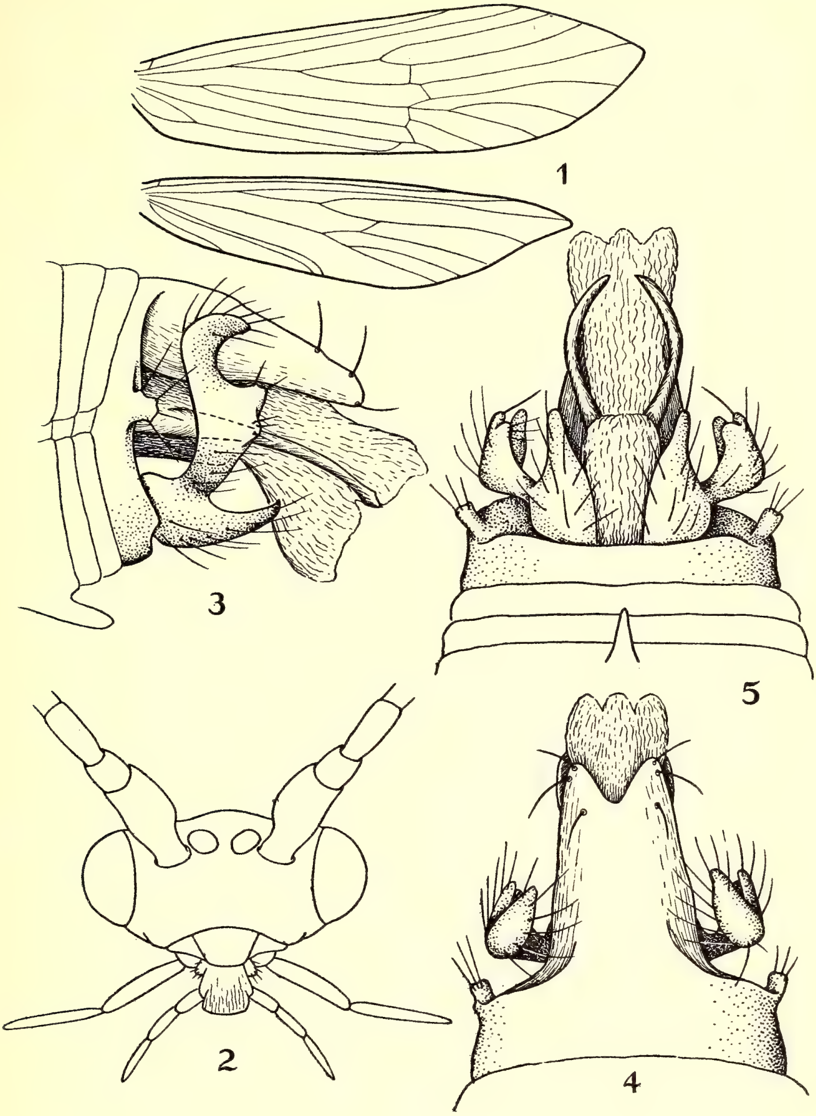
Eothremma punja sp. n., ♂.—Fig. 1, anterior wing. Fig. 2, palpi. Fig. 3, genitalia, dorsal. Fig. 4, lateral. Fig. 5, ventral.



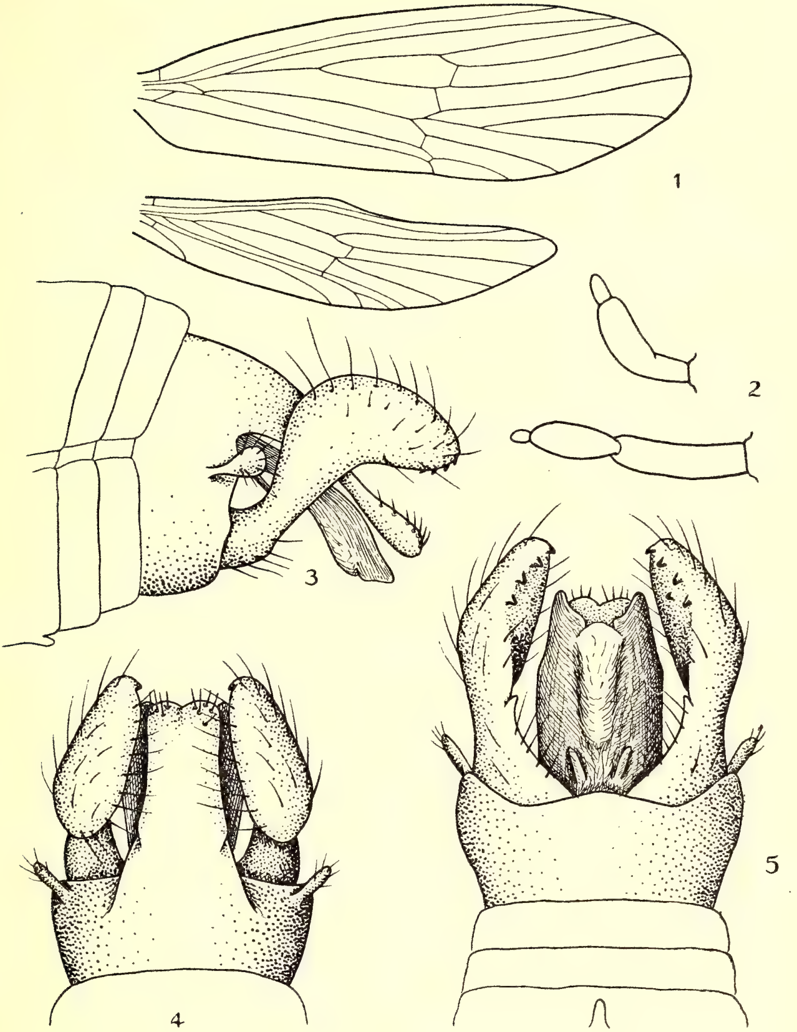
Helicopsyche minuta sp. n.—Fig. 1, wings ♂. Fig. 2, portion of the fifth sternite. Fig. 3, genitalia ♂, lateral. Fig. 4, dorsal. Fig. 5, ventral. Fig. 6, genitalia ♀, dorsal. Fig. 7, ventral.



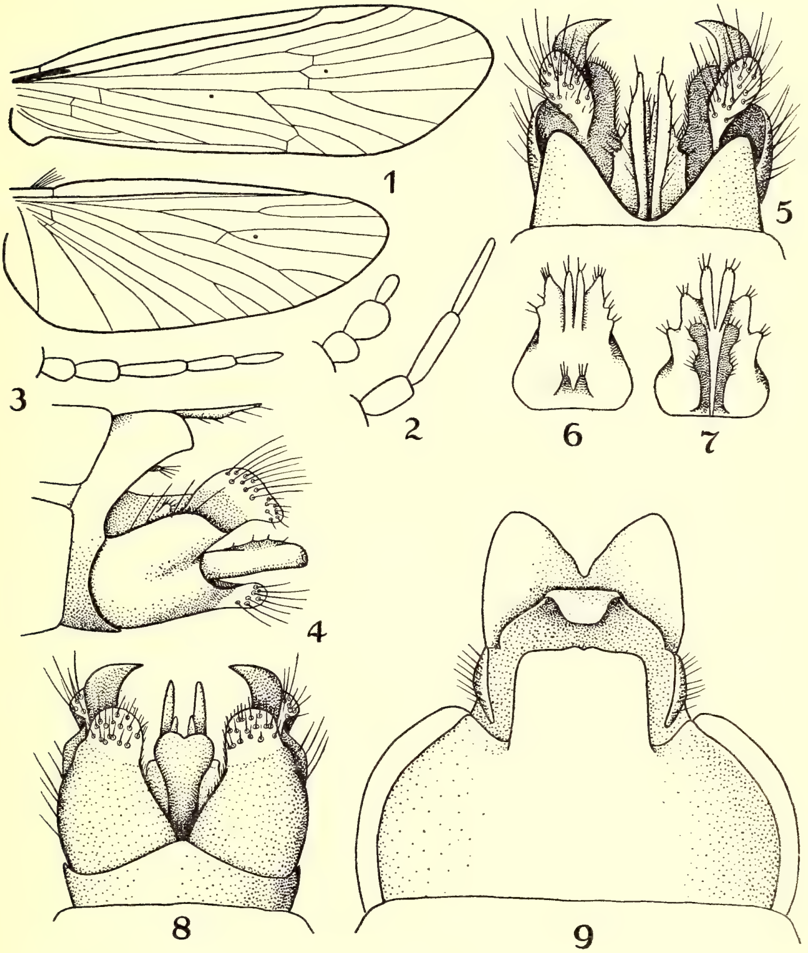
Helicopsyche martynovi sp. n.—Fig. 1, wings ♂. Fig. 2, genitalia ♂, lateral. Fig. 3, dorsal. Fig. 4, ventral. Fig. 5, genitalia ♀, dorsal.



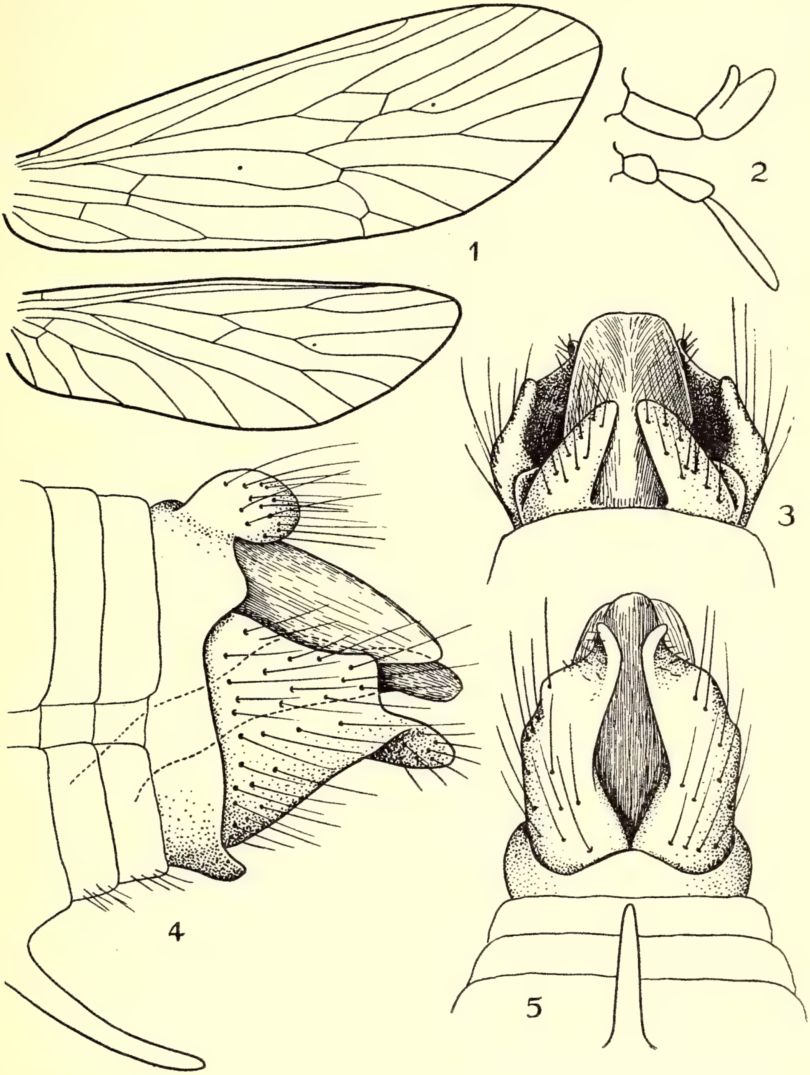
Helicopsyche maculata sp. n., ♂.—Fig. 1, wings. Fig. 2, head, from in front. Fig. 3, genitalia, lateral. Fig. 4, dorsal. Fig. 5, ventral.



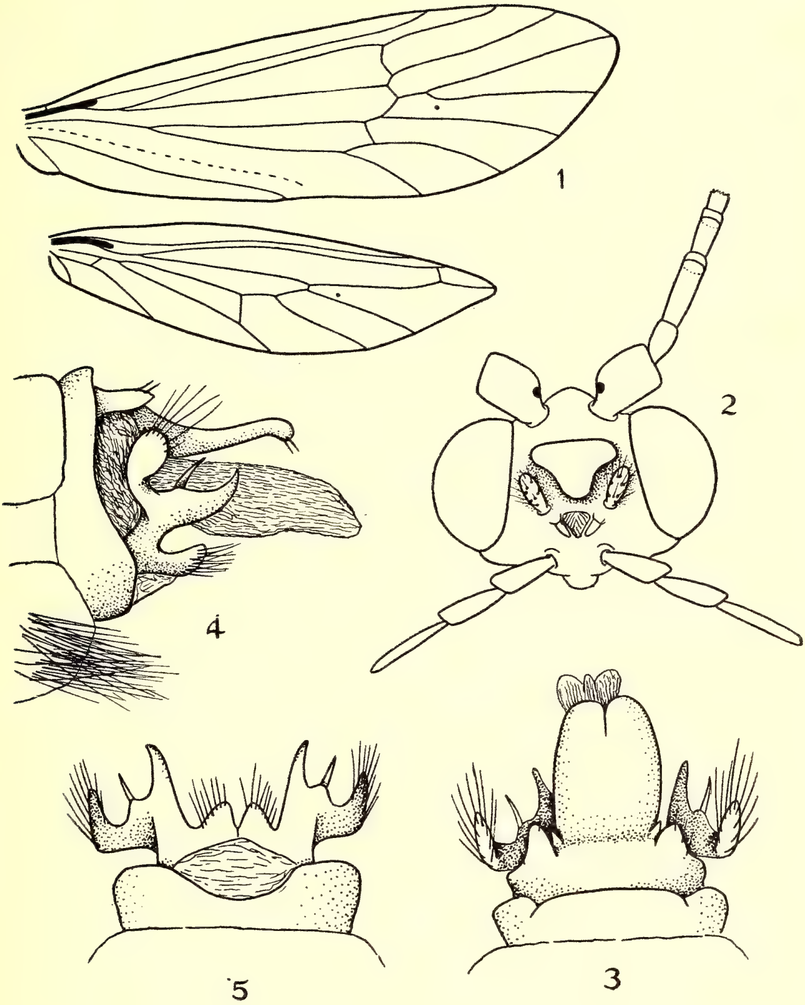
Helicopsyche shaunga sp. n., ♂.—Fig. 1, wings. Fig. 2, palpi. Fig. 3, genitalia, lateral. Fig. 4, dorsal. Fig. 5, ventral.



Ashmira elia sp. n.—Fig. 1, wings ♂. Fig. 2, palpi ♂. Fig. 3, maxillary palpus ♀. Fig. 4, genitalia ♂, lateral. Fig. 5, dorsal. Fig. 6, upper penis-cover, from above. Fig. 7, the same, from another specimen. Fig. 8, genitalia ♂, ventral. Fig. 9, genitalia ♀, ventral.



Gastrocentrides evansi sp. n., ♂.—Fig. 1, wings. Fig. 2, palpi. Fig. 3, genitalia, dorsal. Fig. 4, lateral. Fig. 5, ventral.



Noleka asaka sp. n., ♂.—Fig. 1, wings. Fig. 2, head, from in front. Fig. 3, genitalia, dorsal. Fig. 4, lateral. Fig. 5, inferior appendage and margin of ninth sternite.

I have pleasure in dedicating this species to F. V. Evans, Esq., who has generously defrayed the major part of the cost of the plates for this series of articles on the Indian Caddis Flies.

Noleca gen. n.

Spurs 2, 2, 2. Back of the head produced in a conical wedge, the apex lying between the basal joints of the antennae; the base is almost entirely covered by two large warts extending to the rims of the oculi; vertex bearing an impressed vertical line; antenna with the basal joint large and much rounded, a small round cluster of black scales (?) at the base on the inner surface; second joint about half the length of the third which, like the four or five succeeding joints, is encircled with a raised line towards the apex; maxillary palpi ♂ apparently single-jointed, very small; not covered with scales; there is a large inverted triangular plate on the frons with a broad base and rounded apex, lying between the maxillary palpi; labial palpi three-jointed as usual, all joints of approximately the same length; tibiae and tarsi of the median legs bearing rows of equidistant short black spines; these are confined to the tarsi in the posterior pair and are entirely wanting in the anterior where the tibiae are shorter than either the femora or tarsi; in the single known species, the spurs are 2, 2, 2; in each leg, one spur much longer than the other; wings, anterior with a cross-vein connecting the radius with the sector, enclosing a triangular area which must not be mistaken for a discoidal cell; the neuration is very abnormal; costal margin of the posterior wing elevated at the centre; abdomen bearing tufts of long hairs particularly on the ventral surface.

Genotype: *Noleca asaka* sp. n.

Noleca asaka sp. n. Pl. 12. Figs. 1-5.

Insect generally black; other characters detailed in the generic description.

Genitalia ♂.—Apical margin of the ninth dorsal segment truncate; beyond it is a large, spatulate and sinuous upper penis-cover with an excised apex, directed slightly downward, with a pair of minute, tailwardly directed spurs at its base; on each side are two small triangular projections; penis long and fleshy, from the side, arching downward beyond its cover, apex excised; inferior appendages with four antler-like, widely outspread branches, the basal branches short and rounded, arising side by side opposite the centre of the margin of the ninth ventral segment which is widely excised; eighth ventral segment rather more thickly clothed with hairs than the preceding ones.

Length of anterior wing ♂ 4 mm.

Ceylon: Mousakande, Gammaduwa, 19-24-xi-33.

Type ♂ in the collection of the British Museum, kindly presented by the Colombo Museum.

(*To be continued*).

WILD LIFE PHOTOGRAPHY IN THE MALAYAN JUNGLE.

BY

THEODORE HUBBACK.

(*With Eight Plates*).

HUNTERS AND PHOTOGRAPHERS.

Big Game Hunting in a Malayan Jungle is a strenuous business provided the sport is exercised in the best traditions. Persons who obtain trophies by sitting up for them or by waiting for them in some open clearing never taste the real joys of jungle tracking because jungle lore or craft is not wanted for what is not true hunting, and little knowledge of the animals and their ways is ever obtained by such methods. As the years pass, even to the most ardent followers of big game, the actual killing of large animals for sport becomes more and more distasteful, and although the urge for the excitement of the chase may not be at all diminished still the climax is no longer accepted with unmixed feelings.

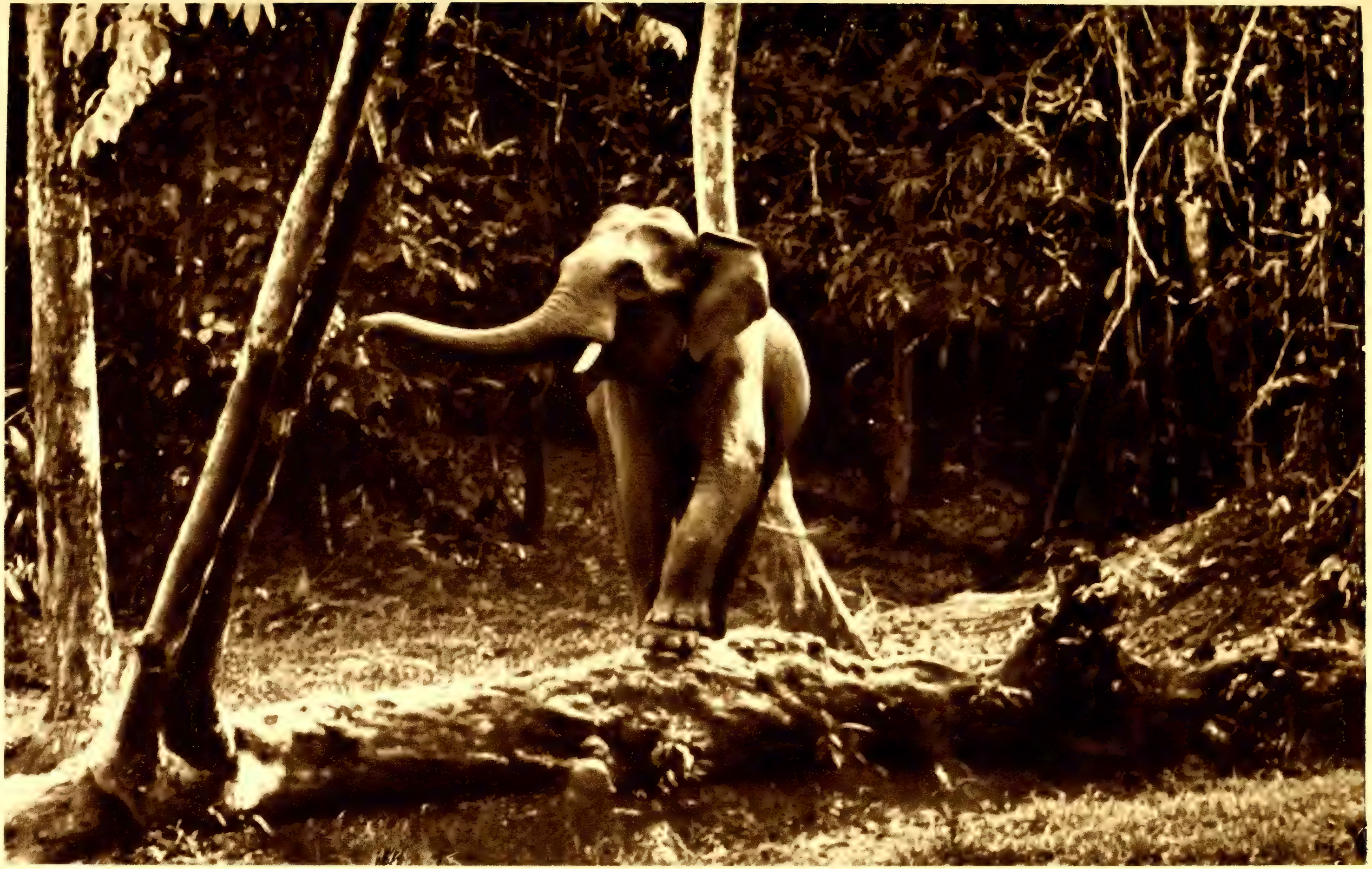
Besides long and arduous treks become more and more difficult until the time comes when ageing muscles will no longer respond to intensive effort. But one's energies can still be utilized in a mild form and one's active interest in large wild life need not become only a memory.

Jungle photography of large animals will fill the blank and will provide not only much excitement but also should be productive of much knowledge of the habits of animals which, now that the rifle is laid aside, can be watched moving about without let or hindrance. I do not wish to imply that wild life photography is an old man's recreation, it is a recreation worthy of anyone, but can be enjoyed after long jungle jurneys are things of the past.

I have heard people refer to those who have given up the rifle for photography, or to hunters who take an active interest in Wild Life Conservation, as 'the penitent butchers', an attractive catch phrase showing the entire ignorance of those who use it.

I believe that unless a man has hunted and hunted a good deal in jungle that he would find the greatest difficulty in adapting himself to the art of jungle photography. Although the technique of the sport of jungle hunting is different in many ways from that of the art of jungle photography, the ground work for success in either must rest on a knowledge of the jungle and the habits of the animals you wish to get in contact with. In other words to be a successful jungle photographer you should be or should have been a successful jungle hunter.

After many years of hunting by tracking in dense jungle such as is prevalent in those parts of Malaya, where large game is or was to be found, one is bound to have accumulated knowledge of



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" I NEARLY FELL OFF."

A Malayan Wild Elephant balancing himself on a fallen tree. This log has been polished by the feet of many elephants playing the same game.

(20 cm. telephoto lens).

the habits of the large wild animals, one of them being that they periodically visit places in the jungle where there are mineral exudations from the ground—generally sulphur springs. Such places are called 'salt-licks'.

SALT-LICKS.

Salt-licks, used for centuries by wild animals, are free for some distance of all jungle growths and so provide a natural clearing surrounded by dense jungle. Often when hunting I have seen animals in these licks, but being sacrosanct where no killing was allowed, I have been quite content to watch the animals until they have left the lick. But it often occurred to me that I might have got a photograph had I a suitable camera. When the time came to lay aside the rifle, I had my knowledge of salt-lick localities and knowledge of the animals also. So I decided to see what I could do with jungle photography. It had never been done in Malaya before, so I had to evolve my own methods. I had tried to get photographs by stalking, and got some good results of dark jungle with a smudge somewhere in the picture, which I was reluctant to show to anyone as a photograph of a bison or an elephant—I could have called it either. I soon realized that such efforts were quite futile and just waste of time. For all practical purposes there is no sufficient light in uncleared Malayan forest for instantaneous photography.

So I devoted my time to the salt-licks. The animals would come to me there; would have to come sometime or other and I hoped it would be during the day time.

Now, although my salt-lick areas admitted more light than there was in uncleared jungle, most of them still required a little attention. I found by bitter experience and heartbreaking incidents that where any cover was left in a lick, a large tree or stump or clump of undergrowth, an animal coming into the lick would so frequently be covered or partly covered by that obstruction that it became more than an unfortunate coincidence, it became a tragedy. My best chances were ruined. So some clearing had to be done. I must obtain a clear view from my hide of the lick and of the approach to the lick. First of all the position of the hide had to be very carefully selected. A hide is useless in a tree because you do not want a bird's-eye view of an animal. On the ground it is easy to disguise a hide so that it is quite inconspicuous, but you cannot disguise your scent, and a suitable site must be sought so that, so far as you can reasonably anticipate, the air currents will seldom take your scent to the lick. I knew one man who went to one of my old hides where I had taken many photographs, sat there for several hours, and smoked large cigars the whole time. That was unfair to the wind. I suppose he was one of those unfortunate people who cannot exist without tobacco? Well he had his tobacco but he got no photographs. You cannot have it both ways.

However careful you are slants of wind may give you away. Try and find a place a few feet above the level of the lick and about 100 to 150 feet away from the main attraction, and you should be comparatively safe from treacherous eddies. As I relate later on, animals sometimes get a slight taint in the wind and become restless, but often remain within photographic distance. But the wind is not the only consideration. The orientation of the hide is most important. It must face as nearly north or south as possible otherwise, during some part of the day, the sun will be peeping into your lenses. In Malaya there is a variation of 47° in the declination of the sun between the Summer and Winter Solstice and a hide suitable for work in June, unless carefully oriented, will not be suitable in December. Malaya is so little north of the Equator that the slightly greater declination towards the north can be ignored.

However these are not difficult matters to adjust; but they should not be overlooked.

That wild animals visit salt-licks more at certain periods than at others is well known to me, but despite every effort on my part to try to correlate the facts that I have observed, I am quite unable to come to any conclusions or to give any feasible explanation on the matter.

When first I became interested in this subject I inquired from native hunters if they had noticed any particular periodicity in the visits of wild animals to salt-licks. I had a variety of answers: many favoured the full moon; some favoured rainy weather; others dry weather. This took me nowhere. So I made notes of my own for some years and discovered that none of the above phenomenon appeared to have much bearing on the visits of wild animals to a salt-lick.

I believe that most sulphur-licks have a variable amount of sulphur in their springs—sometimes one gets a strong smell of sulphur, at other times none—and this may be the deciding factor. Personally I favour the dry weather; as an old Sakai once said to me—the Sakai are an aboriginal tribe—'the deer won't be in the lick there has been too much rain and they don't like the waters too much diluted'. Another factor that operates to keep sambhur deer away from a salt-lick is the presence of elephants. Deer do not like elephants or their smell, and after elephants have been in a lick for two or three nights and have left piles of ordure all round and in the lick, the place smells rather worse than the elephant house at the Zoo.

Besides the sulphur springs are all mixed up with earth and other refuse and I do not blame the dainty deer from fighting shy of such a place. There are probably many other reasons which make a lick attractive or otherwise to certain animals, but only observations over long periods by trained persons would enable data to be tabulated and deductions made.

APPARATUS.

Before dealing with the photographic details I should like to refer to apparatus. I will discuss still photography first. I have no interest in recommending any particular make of camera or

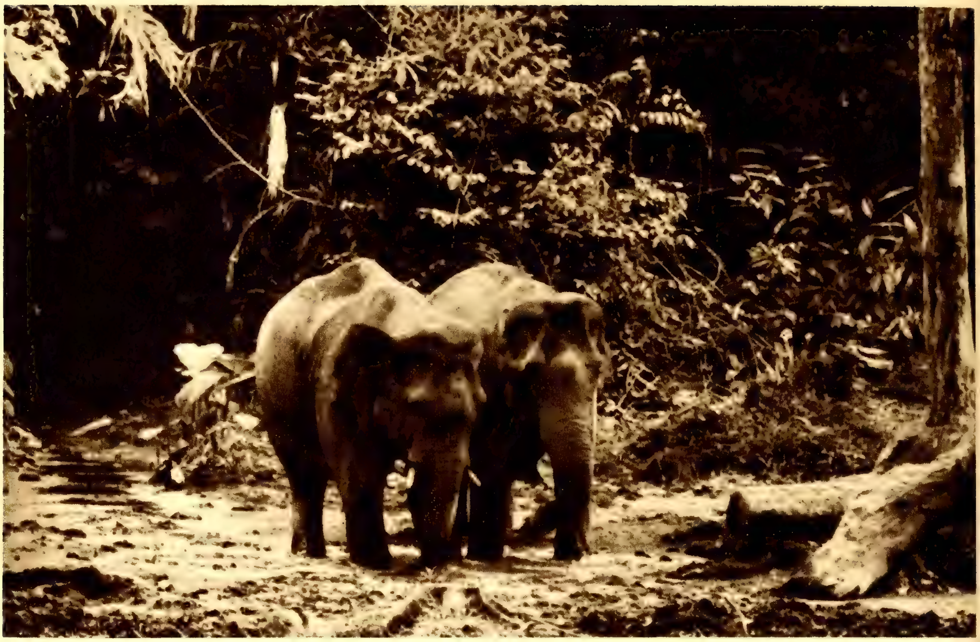

Fig. 1.

Two Wild Elephants in a salt lick mixing their medicine.

(13.5 cm. telephoto lens).

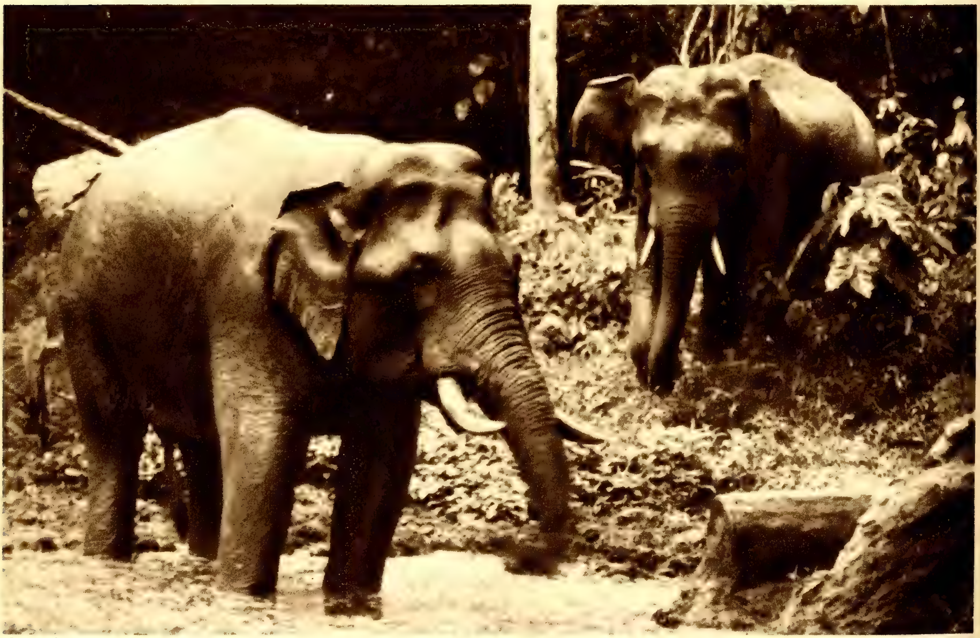

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Fig. 2.

Two Wild Bull Elephants in the same salt lick.

(20 cm. telephoto lens).

film and, where any make is mentioned, it is because I have had experience of or know about it. Since the introduction of the miniature camera, photography of wild life, as I have practised it, that is from a hide, has been greatly simplified. At one time I used a well known make of reflex camera, taking 5″ × 4″ plates or film packs, with which I used a powerful telephoto lens. I got some good results and many poor ones. The lens was too slow for most of the conditions of light that came my way, and the noise made by the shutter was startling. Then I took to using a Leica for which I obtained telephoto lenses and, although I still used my reflex, it has gradually been pushed to one side by what, I have no hesitation in saying, is a more efficient and handy instrument for my purpose.

There are other miniature cameras obtainable no doubt as good as the Leica with equally efficient lenses, but I have had no personal experiences with any of them, so am in no position to draw comparisons.

Of miniature films for this work a fine grain film is necessary, but it must also be very fast, a combination not easy to find. I have experience of Agfa and Perutz films; both brands are excellent. Lately I have got use to Agfa Isopan F. and use it almost exclusively. The Eastman Kodak Company have lately placed on the market three new films for miniature cameras, the fastest (Kodak Super-XX) brings within the range of the animal photographer possibilities of pictures under bad lighting conditions which will no doubt be gladly utilized. The new Kodak Plus-X is somewhat slower than the Super-XX, but is still very fast and a little finer in grain. As all animal photographs will require to be enlarged many diameters the Plus-X film may prove the more suitable.

The Leica camera has a long series of Leitz lenses to choose from; they are not cheap but are super-excellent. A telephoto lens is essential and I have found by experience that the 13.5 cm. 'Hektor' or the 20 cm. 'Telyt' are the most suitable. For salt-lick work a more powerful lens is seldom necessary. In fact at times I have found my 20 cm. a little too powerful.

If you will refer to Plate II showing two elephants in a salt-lick you will appreciate what I mean. In Fig. 2 the big elephant is thirty-five yards from my camera, the picture being taken with the 20 cm. 'Telyt' lens. But it is all elephants which, although what one wanted, would have been more artistic with a little jungle around as in Fig. 1 on the same plate, where we have two elephants in the same lick and almost the same position but taken with the 13.5 cm. lens.

Again in Plate III the photograph of an elephant entering a salt-lick at about 50 yards distance, (Fig. 2) was taken with a 20 cm. lens while Fig. 1 of another elephant taken in exactly the same place but at quite a different time of year, was taken with the 13.5 cm. lens.

Of course an elephant is a bulky subject: smaller animals do not so entirely monopolize the picture, as for instance the sambhur deer shown on Plate VII which were taken with the 20 cm. lens. For photographing small animals the 20 cm. 'Telyt' is invaluable.

Light in the jungle is difficult. Photography in a salt-lick means dealing with a range of light far beyond the H and D exposure curve; and if you expose for the shadows you will have to give so slow an exposure that, unless extraordinarily lucky you will never be able to eliminate movement. So you must compromise. I find that by using a Weston 650 Photronic Exposure Meter, which, when used to measure the average photographic intensity of the light from the openings in the hide where the cameras are, will give you as good an average reading as you can hope to get.

The shading of the sun by a heavy cloud will sometimes increase your exposure by two or three times and on windy days one has to be continually adjusting one's stop.

No telephoto lens should ever be used except in conjunction with a stand. And no stand should ever be used that has not a revolving and tilting top. In other words you must use a stand suitable for a cine camera. There are many makes of such stands on the market, so choose with care.

For sub-standard cine photography of wild life—I am writing for amateurs so I presume the 16 mm. cameras are the ones we are most interested in—two essentials are similar to what one wants for still photography, a telephoto lens and a revolving top stand.

I always use the fastest reversible films that I can get and generally in 100 feet rolls. I have used 50 feet rolls but the risk is too great of having insufficient film to work on when the rare opportunity of taking an animal under good conditions arrives. I have suffered from this parsimony and it is not worth while.

Some workers use negative films and before editing them cut out the useless parts, splice the remainder from which they have positives made. Where much work is undertaken this may be worth while, but I doubt if it is much of a saving in such wild life photography as I am describing.

Lenses are a difficulty because few of the telephoto variety work at a larger aperture than F4, and this is often too small with shutter speeds of 1/25th to 1/30th of a second. I generally use a 2″ lens whose full aperture is F 1.5, and have had some excellent results with this lens. It is not a true telephoto lens but is very suitable for wild life photography in salt-licks. When the light is not good enough for this lens at full aperture one may as well go home.

The conditions governing the taking of still or cine photographs from a hide in a salt-lick are the same, and the appurtenances, excepting for the camera, the similar.

THE ERECTION OF HIDES.

A suitable site having been selected, the building of the hide should be done carefully and with as little disturbance of its surroundings as possible. The size will depend entirely on how many cameras you intend to use and how many people will occupy the

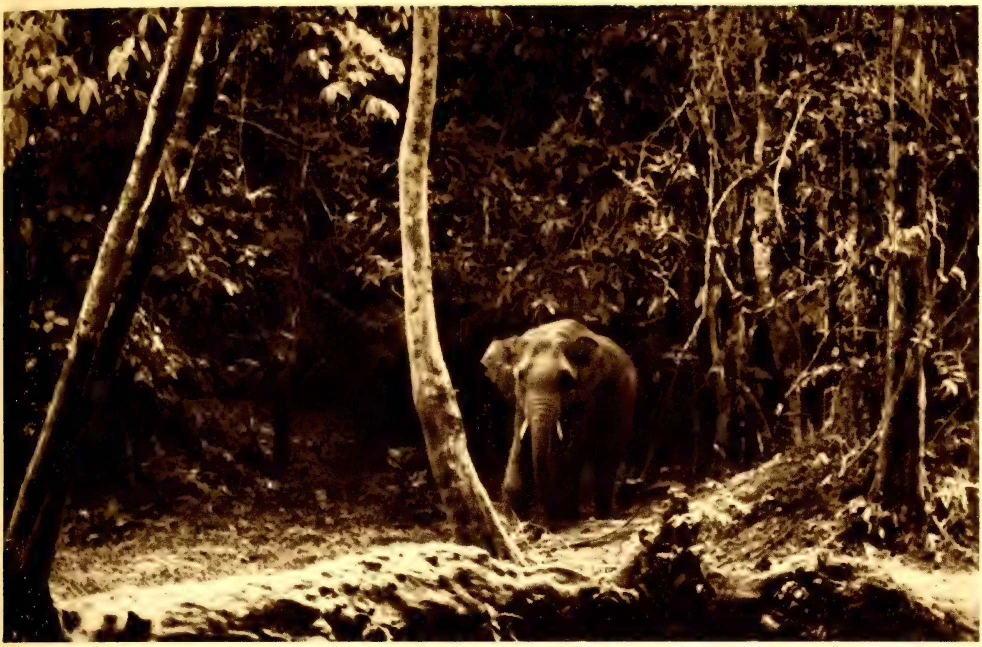

Fig. 1.

A Wild Bull Elephant entering a salt lick.

(13.5 cm. telephoto lens).

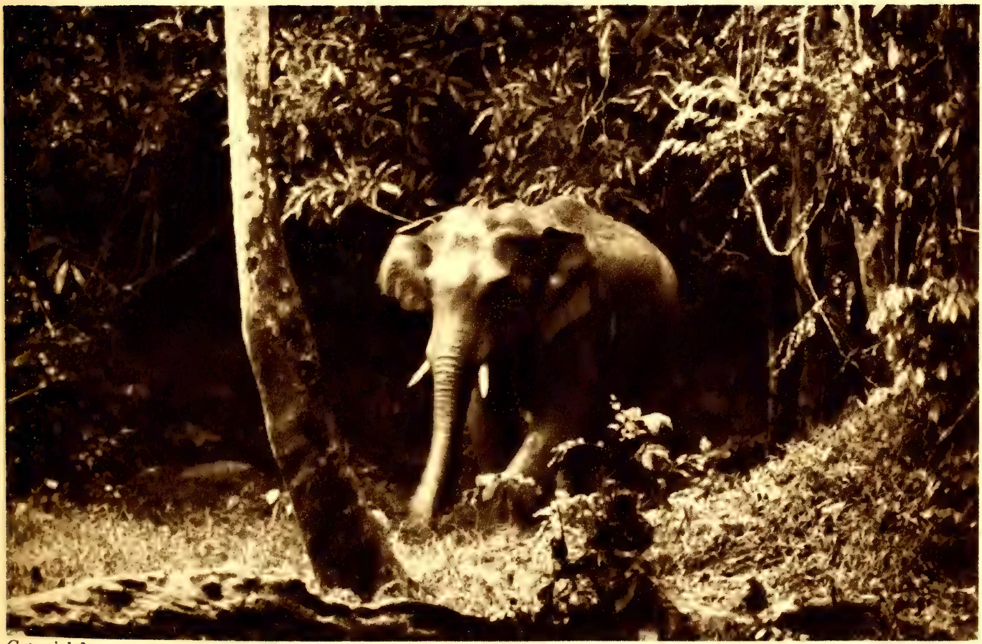

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Fig. 2.

The same place, the same salt lick, but a different elephant.

(20 cm. telephoto lens).

hide. You cannot attend to a cine camera and a still camera at the same time, so will probably have at least one other person in the hide with you. Presuming that the maximum number of cameras you will be using is four then you would want a front of about 12 feet in length to enable you to work in comfort. As you may have to remain for many days it is advisable to make yourself comfortable and the hide must be as roomy as convenient to suit the site.

The front, back and sides are constructed of a light framework of jungle poles—any sapling growing in a suitable position may be utilized—and jungle palm leaves which will provide a complete screen.

On Plate VIII, figure 2 is shown a hide overlooking a salt-lick. It was from this hide that I got the only photograph of a rhinoceros that I have had the good fortune to obtain. The general construction of the hide is fairly clear. All my hides are made on the same lines. The roof, which is invisible in the photograph because it is covered with boughs, consists of a green tarpaulin which is so arranged that the front protects my cameras from rain by overlapping the front screen. Holes are cut in the front screen at suitable heights for the cameras. A good camp chair—the gold-medal American camp chair is the most suitable I know for the purpose—and some sort of small table which I generally make out of bamboo or jungle sticks are desirable. If the lick is surrounded by high ground it may be necessary to dig into a slope to make a suitable site; such details can be solved on the spot, but do not forget to take tools with you to meet all emergencies. The approach to the hide must be masked from the lick and, where openings in the jungle preclude this, suitable screens can be made with jungle palm leaves. One may want to enter the hide when there are animals in the lick and the approach should be selected to enable this to be done under cover. To construct a hide, provided there is not much clearing to do and no earth to excavate, will take three or four hours, and this hide will last until it is pushed over by an elephant, if there are any in the vicinity, or until the palm leaves have withered and fallen to pieces.

Taking the Photographs.

Nothing now remains but to take the photographs of any animals that come into the lick when you are there.

This sounds quite simple, but it is not. Most of the large animals such as elephants and seladang usually visit these licks at night or in the early hours of the morning and late afternoon when the light in such places is not good enough for photography. In Malaya this reluctance to enter salt-licks is no doubt the outcome of such places having been used by poachers for many years. Sitting up in a tree, safely out of harm's way, these nasty creatures have killed many and wounded hundreds of head of big game in salt-licks and it is only natural that animals should give these places a wide berth during the day time. A few years ago it was practically impossible to go into a salt-lick and not find a shooting platform in a tree commanding the lick.

But where a little vigilance has been exercised and poachers have been checked, the animals soon seem to sense the fact that the danger has been diminished, the urge caused by 'that salt-lick feeling' overcomes their fear, and large animals will visit the lick even at mid-day.

To observe an animal's approach to a lick and its behaviour in the lick is an education in itself. Seladang, except old solitary bulls, approach a lick from the jungle edge with the greatest caution, testing the wind from every direction. I have even seen seladang smell the ground, but whether to locate a friend or spot a foe I could not determine.

An old bull seladang is not so careful; on arriving at the edge of the jungle he takes a good look round and then walks straight to the lick. Of course if he gets a bad taint in the wind he turns round and bolts with the youngest of them: their law says you must take no chances with the horrid scent of man.

Sambhur deer are also very wary when entering a lick, but not so scrupulously careful as seladang.

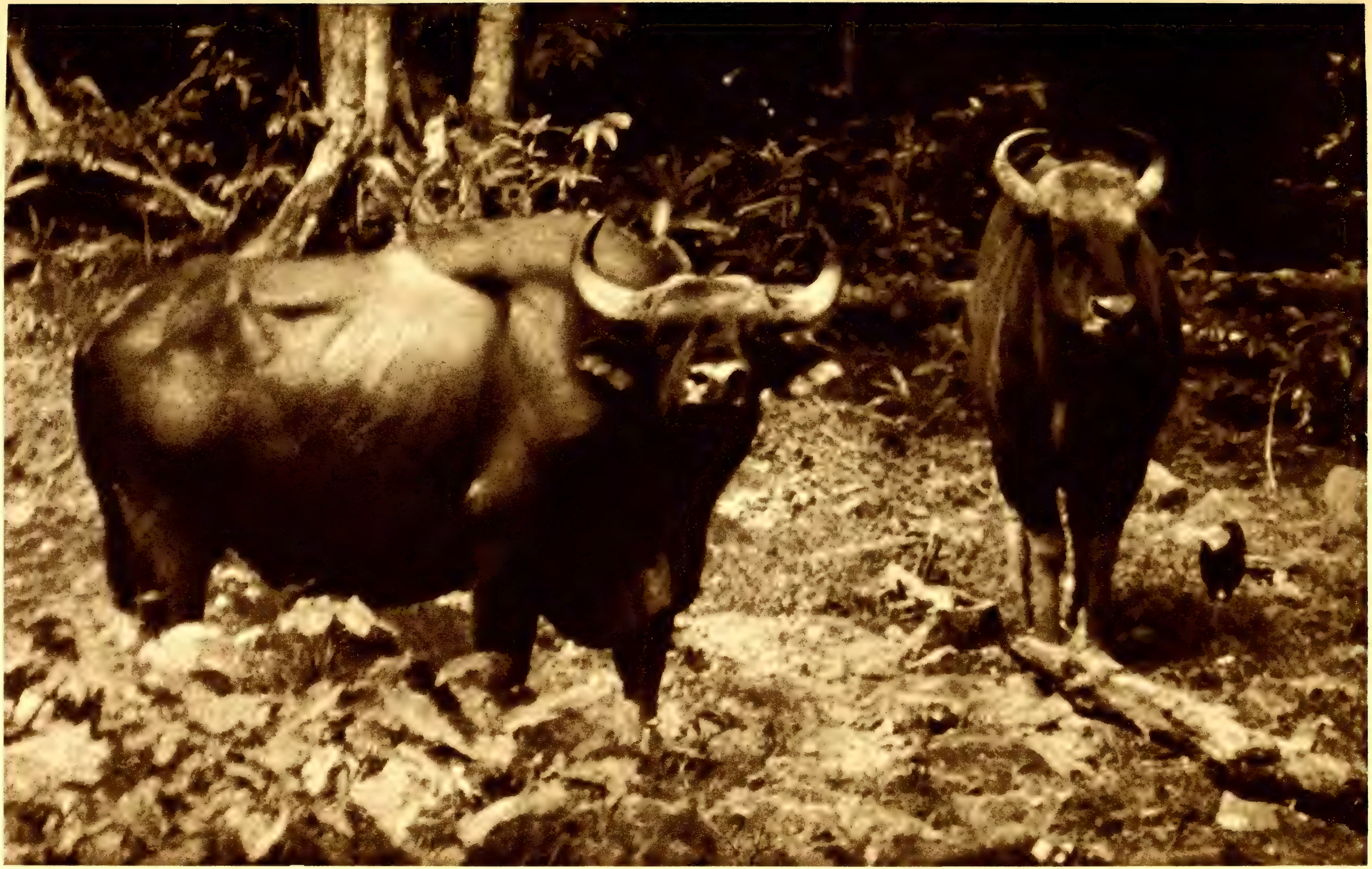
Elephants just enter as if it was any other spot in the jungle.

I cannot say very much about the entrances of rhinoceros into a lick because I have seen this happen so seldom, but I do know that a Sumatran rhinoceros is always in a terrible hurry as if he was obsessed with the fear of missing something. Wild pig are also very fussy in a lick, but they are restless souls at all times and are very difficult to photograph.

All animals when in a lick for some minutes, and provided the air is not tainted, relax their caution and no longer show decided signs of nervousness, but directly they get a taint in the wind, they move back into the shelter of the jungle. I have seen three or four seladang run out of a lick in a bunch, stop just outside the jungle edge and wait there apparently unconcerned. I have seen a young bull seladang, entering a lick very slowly, very cautiously, testing the wind every few steps, turn round and bolt for the jungle, stop just inside and then move leisurely away. Suddenly detecting a taint, he had drawn back so quickly that it looked as if something had hit him hard on the nose. None of these animals react as quickly to the sight of something unusual or when hearing some slight noise which might come from the direction of the hide, it is the scent of Man which is so objectionable to them and, when taking photographs, that is the menace one has to try and overcome with every precaution. Also do not stare too long at any particular animal, especially a seladang, they sometimes get restless. I cannot explain why; I can only give this phenomenon as part of my experiences.

The open clearing in the lick appears to wild animals to be no place to remain in even if they get the slightest taint in the wind.

All this leads up to what should be our procedure, when in a hide ready to photograph we see animals come to the edge of the jungle preparing to enter the lick?



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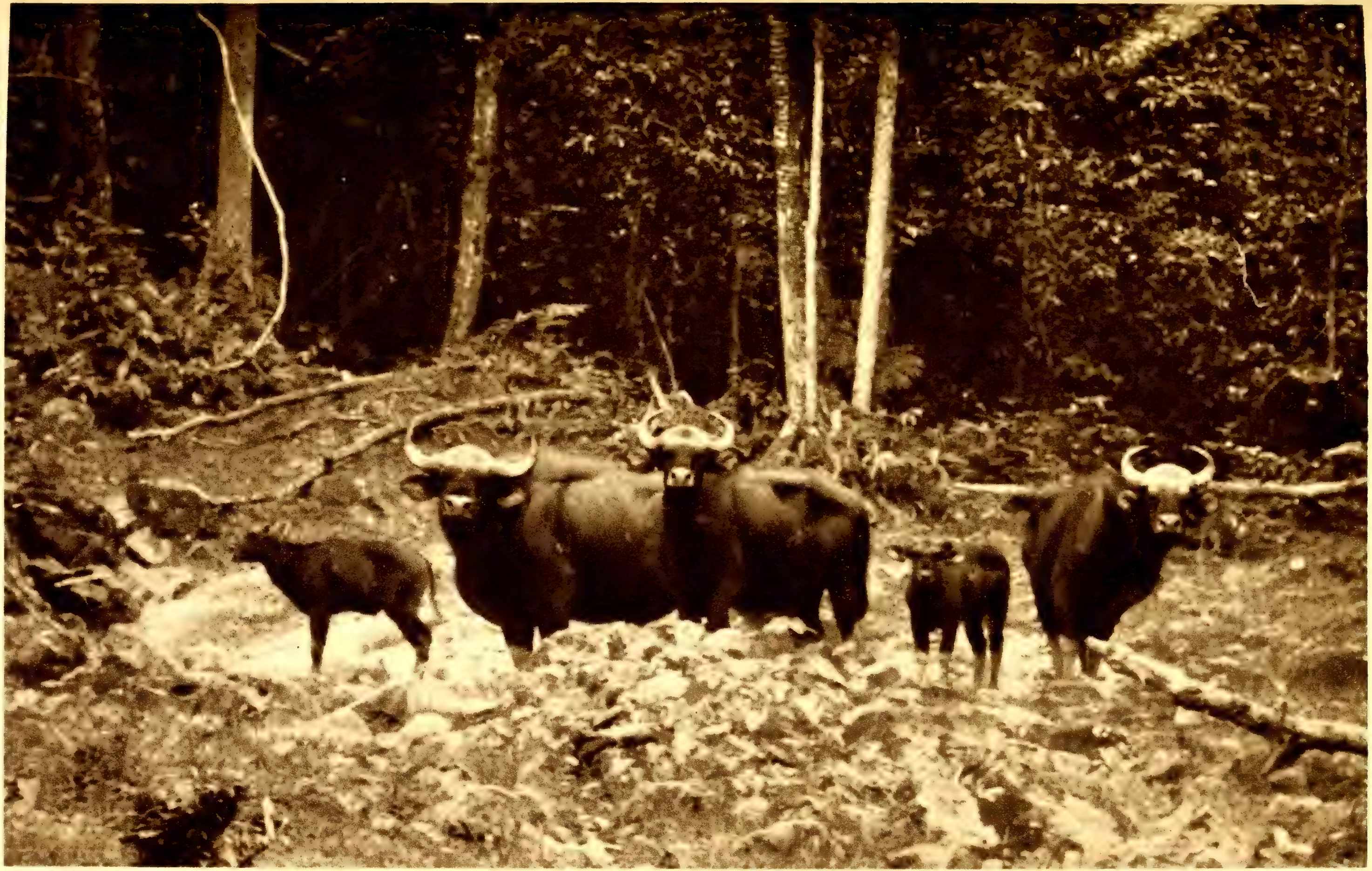
A bull and cow seladang in a salt lick. Both are mature animals. Note the jungle cock which is in attendance on the seladang.

(12″ telephoto lens).



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A group of seiadang in a salt lick. The cow on the edge of the jungle in the background would not come into the lick while the cows with young calves were there.

(17″ telephoto lens with 5″x 4″ plate).

In most places in Malaya, where one can photograph in a lick the far jungle edge will not be more than 200 feet from one's hide, frequently much less. So, generally speaking, directly an animal is clear of the jungle it is photographable, provided there is sufficient and suitable light. Now the temptation is very great to allow the animal to come a little closer as it appears to be about to do and as it probably will do. But I have been caught like that, waiting for a more favourable opportunity and then getting nothing. An unfavourable eddy in the wind, a quick turn, and your animal is in the jungle again.

So now I always start taking photographs so soon as I can and keep on taking them so long as the position and pose is favourable. Opportunities come so seldom that one must seize with both hands what the Gods give us.

It is exciting enough to see a big beast coming closer and closer and getting bigger and bigger in the finder to make one forget details, and sometimes a failure to alter the focus of the lens results in useless pictures. One must train oneself to make the adjustments to one's camera mechanically so as never to forget the focussing ring.

Animals may vary a great deal in their behaviour when in a salt-lick. Seladang and sambhur deer are good subjects for a camera and move very deliberately. If at all suspicious—they may hear the cine camera or see a slight movement behind one of the openings in the front screen—they generally 'freeze' and stare and stare, with possibly a movement of ears and a twitching of the nose, but at other times remaining as still as if carved out of stone. This is your opportunity and good studies can sometimes be made with comparatively long exposures. Elephants, pig and barking deer are not so accommodating being much too restless to make good subjects. An elephant seldom seems to keep his ears still and if he does then he swishes his tail about. Still, one does at times get good opportunities with the resulting good pictures if other circumstances are favourable. Practically all my exposures in salt-licks are made at an eighth of a twentieth of a second. The first will not entirely eliminate movement, but is often necessary due to poor light. The chief road to success is persistence if you have the leisure to persist; at times day after day in a hide with nothing to show for hours and hours of waiting may be discouraging, but the reward will come if you are prepared to wait for it.

OUTFIT.

I think some of my readers may be inclined to say 'That's all very well, but elaborate apparatus has been used and we cannot emulate the results by using our simple cameras.'

It is true that the better the lenses the better the chances one has of getting good results, but that is merely a matter of comparison and very good results can be obtained with quite inexpensive cameras.

To illustrate this Plate VIII, Fig. 1, of two sambhur deer was taken with a Kodak Junior No. 6 by my Malay assistant working from my hide in the same lick where the photographs shown on Plates I, II, III, and VI were taken. At the same lick with the same camera he got photographs of elephant showing four in a group. There is no need to be discouraged on the score of apparatus, if you have knowledge of the animals and their usual haunts and leisure to devote to this fascinating recreation, you will in time achieve results that you will surely be proud of.

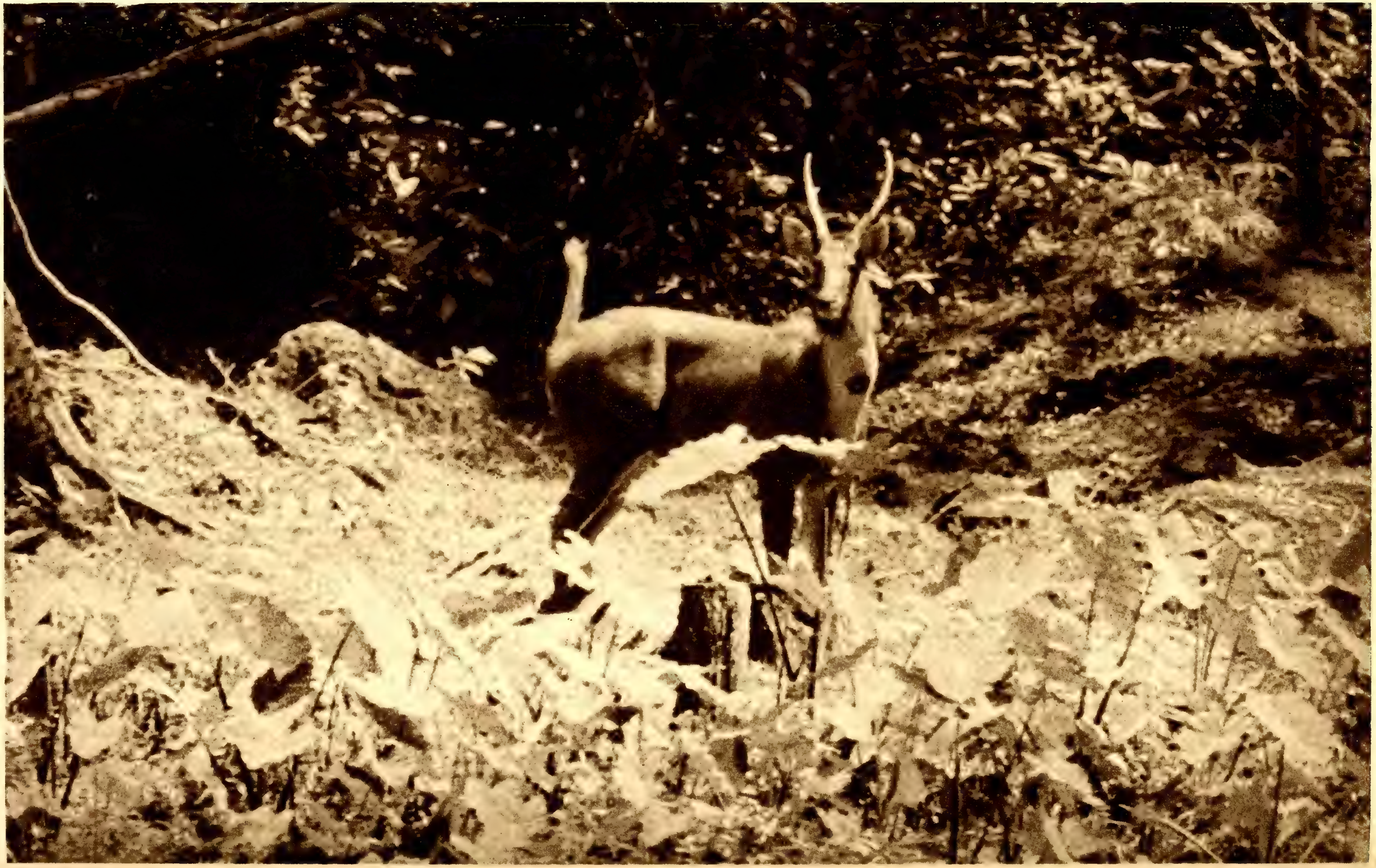
I have been put to some inconvenience at times because of the habit of certain lens makers of engraving the numbers of the stops, (F values), on the front of the ring which opens or closes the diaphragm. After all, the operator must be behind the camera, and the only reason why the stop values are marked on the front is to suit the convenience of the manufacturer not the convenience of the operator. I cannot give a better illustration of how these lenses should be marked for work in a hide, than mention the way Leitz marks his lenses for the Leica camera. Both F values and focussing distances are clearly marked so that they can be read from the back of the camera. You cannot push your head through the front of the hide to look at the face of the lens every time you want to adjust your stop, which will be many times during the day. The Cooke-Hobson 3″ telephoto lens for the Bell and Howell Filmo is well marked and adjustments can easily be made from the inside of the hide, but the 1″ lens is not well marked and not so easily adjusted.

Generally speaking, colour photography is not for the salt-lick photographer because the films are not yet fast enough for this class of work. I believe that the Agfa people have now placed on the market a film much faster than anything yet obtainable, but it has not reached the Tropics yet and I have not had an opportunity of trying it. I have made several abortive attempts with available films and although there may be occasions when the light conditions are good enough for a slow exposure with a large stop, they are very few and far between. However I expect it will not be long before the difficulties of producing a colour film of sufficient speed will be overcome and that will add enormously to the joys of salt-lick photography.

THE MENACE OF DAMP.

The atmosphere in the Malayan Jungle is never dry. All photographers know how easily damp will spoil a film or even a camera, and it is necessary to take some precautions if one is likely to be away on a long trip.

I always take with me two or three drying tins containing some drying agent—silica-gel for instance—in which I keep all opened or unopened films and my cameras when they are charged with partly exposed films. This certainly helps to defeat the damp which during wet weather is a serious menace to one's films. The ideal way is to develop one's films so soon as possible after exposure and, with daylight developing tanks now on the market, this operation has been simplified so that developing one's films in a jungle camp no longer presents any terrors to the nature photographer.



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A Sambhur Deer Stag "Showing the Flag." Observe the sore neck. This is an endemic affection of Sambhur in Malaya, nearly every sambhur deer becomes infected.

I have written nothing about flashlight photography in the jungle for two very good reasons. Firstly I know nothing about it. Secondly such an activity does not appeal to me. However I fully appreciate some of the magnificent photographs of wild life that I have seen which were taken by that method.

ANIMAL PSYCHOLOGY.

I have no hesitation in writing that all species of large wild animals in a Malayan Jungle are governed by a feeling of insecurity, and during the day-time seldom seem to be quite free from the idea that they must never relax their vigilance. Herein is probably the germ of the herd instinct—mutual protection.

I cannot believe that this vigilance is due to fear of modern man and his lethal weapons but is probably a primeval instinct which goes back through the ages to the remote past.

On the other hand this theory is somewhat discounted by the known reactions of certain animals, lions for instance in the Kruger National Park in South Africa, when freed from the menace of the rifle, a freedom they undoubtedly appreciate. Once eliminate the tradition of fear, and wild animals react very quickly to new conditions, in fact, in some instances react too suddenly and the balance of nature is upset. The older the animal the less nervous it appears to be, although its cunning greatly increases with age. The loss of nervousness may be partly due to its mature strength, partly to the indifference of age and the weariness of spirit such age generates. Experience may have taught the older animals that all the alarms and the nervous reactions produced thereby are often not worth bothering about and so they lead a more tranquil life.

All this is a diversion, speculative and possibly unprofitable, but to obtain good photographs of wild animals whose lives are often a hair-trigger existence, we must try to understand a little about their potential behaviour under abnormal conditions. Fear appears to be the dominant motive and we must lay our dispositions to try to overcome that, bearing in mind that by far the greatest fear conveyed to wild animals is by their sense of smell. The felidae are a possible exception.

Only once over a period of years have I had an animal sufficiently curious to come over to investigate what I was after. Sambhur and barking deer often come towards one, stamping their feet and belling or barking, but they seldom come very close and the whole action is one of mild curiosity so strongly developed in deer.

One afternoon, about 5 p.m. I entered an old clearing covered with long coarse grass (*Imperata arundinacea*) and immediately spotted the high back of a seladang on the edge of the clearing. He was moving slowly and feeding sparingly. A gentle breeze wafted his bovine scent towards us. I was entirely in the open, but was able to hide myself behind a large ant-hill also covered with long grass. I had a cine camera and a still camera with me. I scrambled up the ant-hill so that I could see over the grass but was then in full view of the seladang. I could now see that he was an old bull with much-worn horns.

As he raised his head from time to time I tried to photograph him. He looked straight towards me from about forty yards distance, but did not appear to see me. He may have been a little blind. Presently he fed closer and finally did spot me or some movement I made and raised his head well up. He stared and stared, swishing his tail from side to side. Then he threw his head up and down two or three times and started to walk towards me but slightly across my front. He was now within less than thirty yards and I thought that this was close enough, so I picked up my apparatus and backed towards the jungle edge which was ten yards behind me. I had two Malays with me; one of them had already disappeared. When I got down from the side of the ant-hill I could see nothing. We waited inside the shelter of the jungle and heard the seladang snuffing about apparently close to the ant-hill. My boat was tied up to the river bank forty or fifty yards away. I told the Malay with me to come along and bring the outfit, and then discovered that he had left my camera case and a rubber cushion on which I was kneeling. Well! we could not go back at the moment, so went down to the boat, where we found the other fellow, and poled up stream a few chains to where I knew there was a crossing with a game track leading up to the clearing which I expected the bull had used when entering the clearing. Sure enough there were his tracks, so fresh as to show that he had only preceded us by a few minutes.

We got out of the boat and climbed up the bank to reach the clearing and out-flank the seladang. One of the Malays being more active than myself got to the top yards ahead of me and seeing no signs of the bull turned sharp left towards where he had left my camera case and my cushion.

Suddenly a magnificent snort from the bull sent him running back in about even time, anyway far faster than he had ever run before, and hurling himself down the bank very nearly upset us who were coming up behind. Then we heard the pounding of the seladang's hooves getting fainter and fainter as he rushed through the clearing for the safety of the far jungle.

What had happened was this. Up to the arrival of the Malay at the top of the bank the bull had never got our scent properly, but I think that he must have been not only a little blind but his power of smelling must have been deficient too, because when we did recover my belongings we found that he had been all round the place and had actually stamped on my cushion. But he finally reacted according to book. When he was quite certain what all the fuss was about, after getting the scent of a much perspiring Malay he realized that it was no place for him.

'Stand not upon the order of your going, but go at once.'

I only got fair photographs; balanced on the edge of an ant-hill I was not in an ideal position.

An incident with a tiger which resulted in no pictures at all, serves to illustrate the ever present fear that is always only just below the surface with wild animals.

About half past seven one fine morning, having left camp half an hour earlier, my friend P. and myself were approaching a salt-

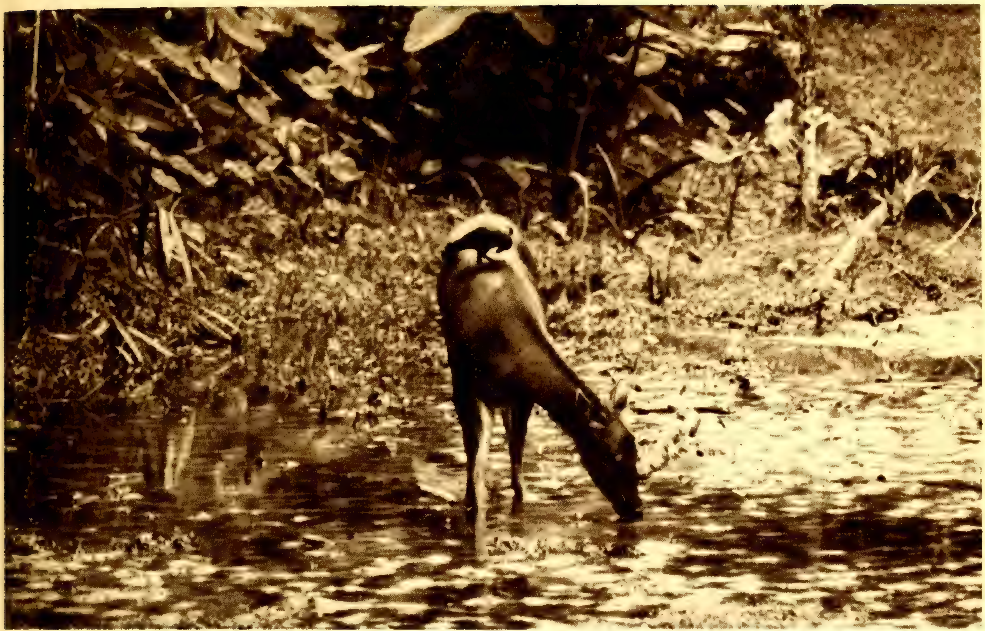

Fig. 1.

" DOING HIS GOOD DEED FOR THE DAY."

A Crow picking off ticks from a doe Sambhur Deer.

(20 cm. telephoto lens).

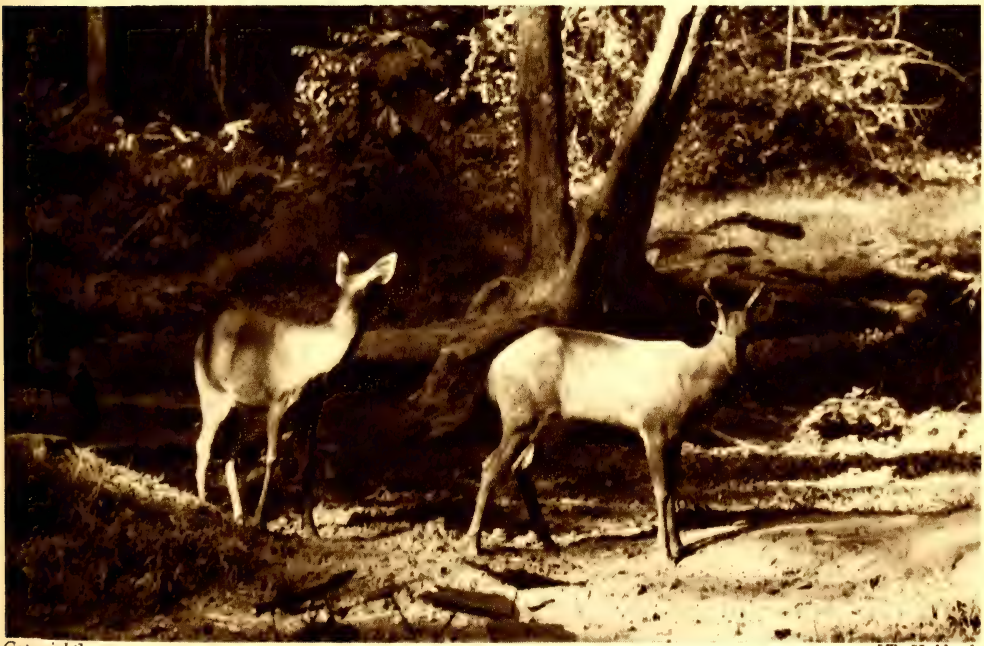

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Fig. 2.

Sambhur Deer in a salt lick. This is the same lick shown in Plate 1. Elephants were not about when this picture was taken.

(20 cm. telephoto lens).

lick hoping for photographs of seladang or sambhur. When about a quarter of a mile from the lick we had to top a sharp rise and mounting this rise I heard, somewhat indistinctly, an animal call from the direction of the lick which I thought was a seladang. I turned to P. and said that I thought seladang were in the lick.

Topping the rise and nearing the lick we then heard the unmistakable *AA-oh, AA-oh* of a tiger. That's what I now realized I had heard the first time.

We had been in the lick the previous day and the tripods for our cameras were in position; the cameras were with us. We had two hides, P.'s being about forty yards from mine. We parted company getting into the hides as quickly and stealthily as possible.

The moment I looked through one of the openings in the front of the hide I saw a fine tiger on the edge of the jungle fifty yards from me and coming straight in my direction. My Leica was in my hand with a 13.5 cm. lens attached to it. Like a fool I put it on the stand obsessed I suppose, with the idea that a telephoto lens must be put on a stand. I had no tilting top in those days, in fact this incident cured me of trying to do without one.

There was a gentle slope towards me—down which came the tiger—rolling his head from side to side, his great bowed legs conveying the very acme of power. He gave vent every few strides to a resonant *AA-oh, AA-oh*, just to show, I suppose, that he was well fed and quite pleased with himself.

In the meantime to bring the tiger within my finder, I frantically tried to adjust the tripod—my Leica was pointing to the top of the slope—I miserably failed. The tiger, a magnificent sight with a great ruff round his neck, came within fifteen yards of me, and then to avoid some wet ground turned left giving me a perfect broadside view which would indeed have filled my picture. What a chance—a close up of an unsuspecting tiger. When making the turn he must have caught a movement—I was probably making many movements wrestling with my tripod—hesitated, turned his head in my direction and immediately saw me. He curled up his lips, snarled, swung round very quickly and lopped off in the direction he had come, but this time with his tail well tucked in and no signs of being at all pleased with himself.

On the edge of the jungle he stopped a moment, stretched up a tree to clean his claws on the bark, and was gone. I got nothing except the memory of the incident; still a very vivid and very sore one.

I wondered what luck P. had had. But enough of failures. He also was unsuccessful. He did get some few feet of cine film but it was badly underexposed and the tiger was not very close to him.

Had I kept my Leica in my hand I could have got some exposures, but with a telephoto lens I would have almost certainly have had blurred negatives. The light precluded a fast exposure.

This is the only chance I have ever had of photographing a tiger, although, not very long ago, I had a tiger come past my hide, but on the wrong side.

We were waiting for sambhur in a salt-lick in a very different part of the country to the lick I have been writing about. Shortly after mid-day I heard a tiger call in the far jungle. We had seen tiger tracks on the trail leading to the lick and as there was frequently a tiger in the vicinity I thought that possibly it might pass through the lick. I looked over my cameras and had everything ready when we heard three or four shattering roars quite close to the left side of the hide. I thought the tiger might pass just in front of me but unfortunately it passed directly behind the hide and came within eighteen feet of the opening at the back of the shelter. It then stopped. Unfortunately I had put out at the back, well sheltered I thought from the gaze of any animal, a white singlet to air. The tiger saw this, otherwise I think he would have passed along. One of my men who was nearest the entrance shuffled towards one of the others and this movement immediately attracted the tiger's attention. It turned round and 'beat it' up the trail it had just come down. I was at the far end of the hide and did not see the tiger until it turned to flee. It was not an old tiger, but very well marked. I asked my man why he had moved and what he was frightened about? With a face as white as a Malay's face can go he brazenly said that he was not frightened but moved to get a better view. I think that man would make a good liar if he really tried!

At times animals will behave in a peculiar manner when about to enter a salt-lick; there is generally some very good reason for any exaggerated caution but we are seldom able to find out what that reason is.

On one occasion I watched a young sambhur stag on the jungle edge of a lick quite unable to make up its mind to enter. He sniffed and sniffed, moved his head backwards and forwards, right and left, ears shifting in all directions; still he would not come in. Once he came within one step of the clearing and backed again into the jungle. He behaved like this for three-quarters of an hour and then came into the lick for a few minutes. But here I knew or thought I knew what the trouble was. Wild dogs were in the vicinity, and no doubt that was the reason for the deer not liking to go into the lick in the daylight. Wild dogs do not hunt in jungle during the night, and that may be one of the reasons why sambhur and barking deer so much prefer to go to a lick at night in country where wild dogs are to be found.

Occasionally one observes incidents of the behaviour of species to species, but there is not always the opportunity of recording the occurrence. One incident, amusing and instructive, I have often thought over.

A young bull seladang, little more than a calf, was moving along a game trail leading out of a salt-lick. He was skirting the jungle edge when a well grown sambhur doe came into the lick from the opposite direction following the same trail. The seladang stopped immediately, but the doe carried on until within about ten yards of the seladang. They stared and stared at each other but neither would give way. They kept very still; the seladang switched his tail and shuffled his forefeet; the doe twitched

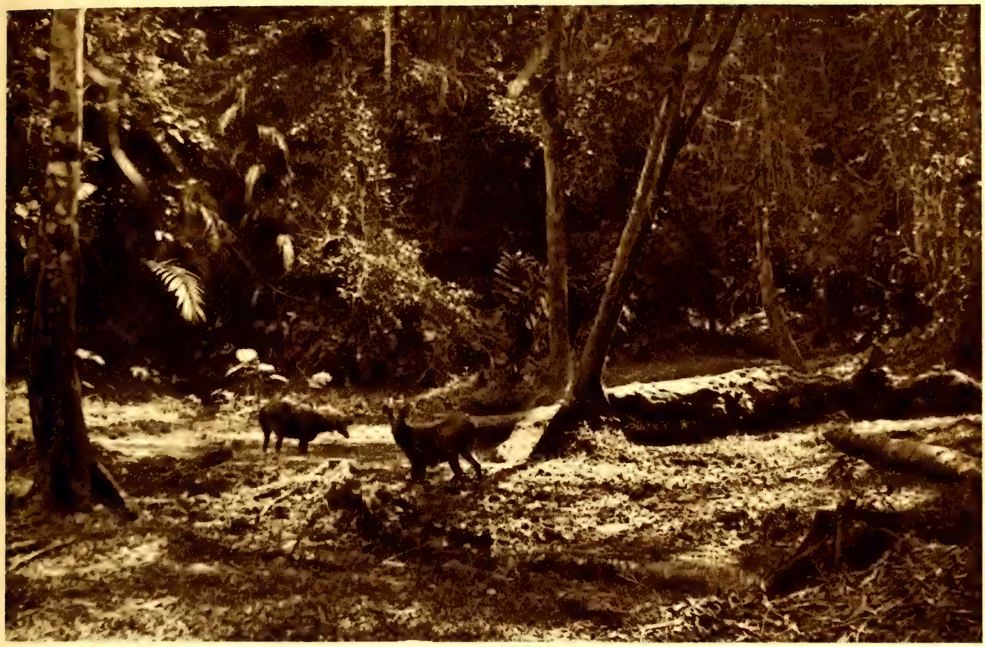

Fig. 1.

SAMBHUR DEER IN A SALT LICK.

(This picture was taken with a Six-20 Kodak Junior Camera).

Copyright] [*T. Hubback*

Fig. 2

HIDE IN A SALT LICK.

From this hide the only photograph ever taken of a Sumatran Rhinoceros was obtained.

$7\frac{1}{2}''$ "Express" lens. $5'' \times 4''$ plate.

her ears and once or twice turned her head to look straight down the middle of her back in the way sambhur have, as if she was expecting another sambhur to join her. After about five minutes of this the doe daintily stepped off the trail, made a half circle through the jungle and joined the trail behind the seladang. The little bull never looked round but presently continued his interrupted journey out of the lick. What did they think of each other? Seladang and sambhur often meet in that lick—no doubt these two were not strangers. I think each was waiting for the other to say 'after you'? Finally the sambhur, no doubt looking forward to a good drink at the lick which it had still to reach, pretended that it wanted to go by another route and gave the seladang a wide berth.

On another occasion in the same lick a young bull seladang and a mature cow were drinking when a sambhur doe came into the clearing, some way from the seladang. She walked directly towards the seladang and stopped when between the two of them. The three animals were within a circle of ten yards. The cow seladang turned her head with a gesture implying surprise as if she would like to say, 'Well! and what do you want here?' The bull took no notice at all.

I managed to secure some photographs of this group. What would have been the ultimate outcome for this 'gate-crasher' I never found out because one of the seladang becoming alarmed the two turned quickly round and made for the jungle; but the doe, standing facing me, never moved a muscle, 'froze' in a rather stilted position most of its weight on three legs, and so remained for several minutes. It then started to drink at the lick.

It is useless to speculate as to what sambhur will do under abnormal circumstances. In a lick, they are not as alert as seladang; still when photographing them take no chances and never forget that they are wild animals to whom the dread scent of man conveys a deadly sense of fear.

I was on one occasion in this very lick exposing a cine film on two sambhur, a doe and a big stag. They were about 40 yards from me. The doe was very busy in the lick but the stag was somewhat lethargic and presently lay down. As he was amongst boulders he was almost invisible and I knew he would be indistinguishable in the photograph as the light was poor. So I stopped my camera and waited. Nothing happened. I made a slight noise and the doe immediately looked up. I softly clapped my hands and the doe then became alert, stamped a forefoot, turned round and started to walk out of the lick, her tail well up and stepping carefully with deliberation, lifting her forefeet like a high stepping horse. The doe disappeared, the stag gave no sign of even being alive! I then clapped my hands without restraint and imitated, or thought I imitated, the bell of a sambhur. Still nothing happened. I then moaned like a tiger. A slight movement of the antlers. This was a bit too much even for my patience, so I put my head out of the hide and shouted, 'Get up, you lazy old devil'. He heard that and very slowly struggled to his feet, looked with what I fear was supreme contempt towards me—those foolish efforts at imitations—and walked slowly out of the lick. He was in fine condition and obviously in excellent health.

Perhaps for him it was 'The morning after the night before?'

On the other hand, sambhur sometimes show an extraordinary nervousness which it is difficult to account for.

I was photographing a young stag in a lick when without warning a helmeted hornbill (*Rhinoplax vigil*) flew into a tree behind my hide creating, as they so often do, a good deal of fuss. The sambhur started violently at the noise, although it must have been a familiar one to him.

Then the hornbill left the tree and flew right over the lick making a most infernal row. This was too much for the sambhur who turned and rushed for the jungle. Of course the hornbill may have conveyed to the sambhur a warning of something unusual which the deer was quick to act upon; anyway it was an interesting little glimpse of nature with the lid off.

What has always struck me and still strikes me about wild animals going about their lawful occasions when undisturbed and unafraid is their extraordinary deliberation. Except when alarmed there is no fuss, no rushing to get there first, no hurry. We can well learn much from a close study of Nature.

Great caution is generally shown when entering a lick by all but elephants and very old seladang, although I always suspect that elephants very carefully test the wind when still some distance from the lick, and when they find it all right walk straight into the lick. If they find it all wrong you do not see them at all.

I was once in a lick when a big sambhur stag came in. He was a magnificent specimen. He approached very cautiously, stopping every few steps and took a long time coming within my range. I was using a reflex camera whose shutter went down with a bang and I seldom got a chance of more than two exposures, if as many. I used film packs in that camera. The stag after many false starts settled down and came within 35 yards of me. I then got into action. I expected to see him run so soon as I released my shutter but all he did was to start and shudder as if in protest at such an unnatural noise. I actually exposed six films on him. He shuddered every time but otherwise took no notice at all. Finally he walked away. His change from extreme caution when entering to entire indifference when once settled down in the lick, despite the noise of the shutter, seems to me to point to the fact that if these animals are satisfied that all is well they rely on their safety in the open space in the lick. No tiger could stalk them in a lick—I do not think they ever try—and wild dogs leave so much scent behind them that were there any in the immediate neighbourhood the sambhur would know and act accordingly.

CONCLUSION.

I often hear persons who should know better upholding the practice of carrying firearms when in the jungle as a defence against unprovoked attacks by wild animals. As a cold fact unprovoked attacks by unwounded wild animals in the jungle is a myth, and it is quite unnecessary to make any provisions for carrying firearms unless one is hunting.

I never think of taking a firearm with me into a hide, and none should be permitted to do so.

One has many days sitting in a hide on the edge of a salt-lick when no opportunities for photography will occur, but one never has a blank day so far as interest in wild life is concerned, because things are always happening which are of vital interest to the nature lover.

The distant call of the seladang, the faraway trumpet of an elephant, the moaning of a tiger, the wonderful call of the Argus pheasant, so often answered by another one from some distant ridge or strutting ground, the numerous species of birds which one sees and hears, all combine to make a dull day in a hide in a Malayan jungle, an impossibility to anyone who can appreciate the real voice of Nature and be thankful for the peace and comfort that it can and does bring to the human race.

THE GAME FISHES OF INDIA.[1]

BY

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(*With one plate and two text-figures*).

Continued from page 593 *of Vol.* xl.

VII.—THE MULLEY OR BOALI.

WALLAGONIA ATTU (Bloch and Schneider).

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INTRODUCTION.

The most predaceous fish encountered by anglers in the tanks of India is the so-called Freshwater Shark, designated so far in scientific literature as *Wallago attu*. On account of its forbidding aspect and unclean feeding habits it is not usually eaten by the higher classes, yet there is a fair demand for it and it forms one of the important food-fishes of India. Further, in Bengal the fish is particularly valued as an offering to the goddess *Kali*. Though the *Mulley* is generally more abundant during the warm season, considerable quantities of it are offered for sale in all parts of the country at practically all times of the year. Owing to its wide distribution and familiarity it is known by an amazing variety of vernacular names in different parts of India, and very often it is puzzling, when in conversation with fishermen, to make out what kind of fish is meant.

Like other Catfishes, the *Mulley* is devoid of scales and is provided with long feelers. It is a greatly elongated fish, with the head as the broadest part. It has a huge mouth armed with two broad bands of rather large, sharp teeth. It grows to an

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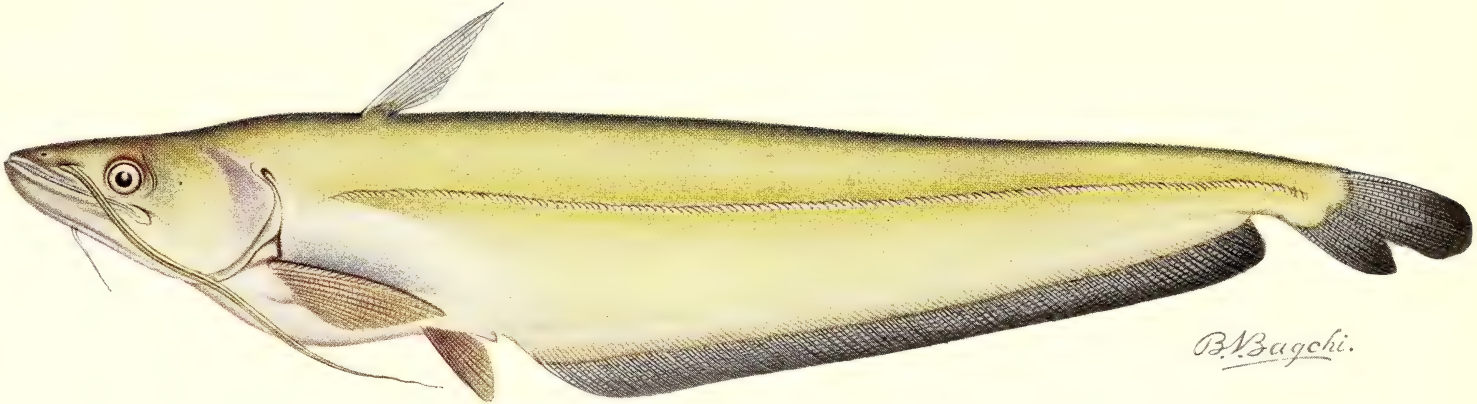
[1] Published with permission of the Director, Zoological Survey of India.



THE MULLEY or BOALI

Wallagonia attu (Bloch & Schneider).

immense size and according to Hamilton (**4**)[1] sometimes specimens of six feet in length are met with. Fish weighing over 100 lbs. are not rare.

Owing to their predaceous habits, these fish are very destructive, in confined waters, to other more valuable food-fishes, such as Carp. Their presence in a tank is almost a sure indication of the absence of any other type of fish in it. As the *Mulley* can be readily fished out with rod and line it is always advantageous to clear the fishery tanks of this pest before introducing any young fry in it. Generally, they prefer muddy tanks, especially those which are subject to periodical flooding from a *nallah* or river during the rainy season. It is stated that they are far more plentiful in such tanks than in those which are fed more frequently by artificial channels.

NOMENCLATURE AND SYSTEMATIC POSITION.

The *Mulley* was originally described as *Silurus attu* by Bloch and Schneider in their *Systema Ichthyologiae* (p. 378, pl. lxxv, 1801). In 1803, Russell (**9**) gave an account of the fish under its vernacular name *Wallagoo*, but regarded it as a *Silurus*. In describing *Silurus boalis* Hamilton (**4**) recognised its close affinity to the *Wallagoo* of Russell, but pointed out a few minor differences in the number of fin-rays, etc. The fish was described under different names by later ichthyologists (*vide* Synonymy on p. 66), but in 1862 Bleeker (**2**) referred it to his genus *Wallago* and revived its original specific name *attu* given by Bloch and Schneider. Ever since it has been known, both popularly and in scientific literature, as *Wallago attu*. In 1936, however, it was pointed out by me (**5**) that in accordance with the strict application of the International Rules of Zoological Nomenclature *Wallago* should be used for those species which are at present included under *Belodontichthys* Bleeker and a new name proposed for *Silurus attu* and its allies. However, in view of the great familiarity of the generic name *Wallago* in its present-day accepted sense I did not make any change in nomenclature. Myers (**7**) independently found the impropriety of using *Wallago* for *Silurus attu* and proposed for it the genus *Wallagonia*, with *Wallago leerii* Bleeker as the genotype. He included three species in his new genus, viz., *Wallagonia attu* (Bloch and Schneider), *W. miostoma* (Vaillant) and *W. leerii* (Bleeker). In view of these recent nomenclatorial changes the *Mulley* should be known now as *Wallagonia attu* (Bl. & Schn.).

Wallagonia Myers is included in the family Siluridae (Order: Siluroidea), which is characterised by the possession of a very short, spineless dorsal (at times it may be rudimentary or absent altogether), a very long anal and one or two pairs of barbels.

Regan (**8**) observed that 'This family has usually been united with the Schilbeidae, but the two have little in common beyond the elongation of the anal fin. The many-rayed pelvic fins, the contiguous or confluent anal and caudal, combined with the absence of a dorsal spine, of an adipose fin, and of nasal barbels, characterize the Siluridae externally, whilst the osteology is quite different from the Schilbeidae, with their rod-like palatine, frontals with free edges, and lateral ethmoids not projecting outwards.'

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[1] Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the 'List of References' at the end of the paper.

Among the Siluridae, *Wallagonia* is characterized by the possession of a short dorsal fin of about 5 rays, by the deeply forked caudal fin, which is free from the anal fin, by the free orbital margins to the eyes and by the position of the eyes above the level of the corners of the mouth.

Synonymy and Description.

Wallagonia attu (Bloch and Schneider).

1801. *Silurus attu*, Bloch and Schneider, *Syst. Ichth.*, p. 378, pl. lxxv.

1803. *Silurus* (vern. name *Wallagoo*), Russell, *Fish. Vizag.*, ii, p. 50, pl. clxv.

1822. *Silurus boalis*, Hamilton, *Fish. Ganges*, pp. 154, 375, pl. xxix, fig. 49.

1839. *Silurus Wallagoo*, Cuvier and Valenciennes, *Hist. Nat. Poiss.*, xiv, p. 354.

1839. *Silurus asotus*, Cuvier and Valenciennes (*nec* Linnaeus), *ibid*, p. 358.

1839. *Callichrus macrostomus*, Swainson, *Nat. Hist. Fish.*, etc., ii, p. 306.

1841. *Schilbe boalis*, Sykes, *Trans. Zool. Soc. London*, ii, p. 368, pl. lxiv, fig. 3.

1846. *Silurus Mulleri*, Bleeker, *Nat. Geneesk. Arch. Ned. Ind.*, iii, p. 289.

1847. *Silurus Mulleri*, Bleeker, *Verh. Bat. Gen.*, xxi, p. 56.

1849. *Silurus boalis*, Jerdon, *Madras Journ. Litt. Sci.*, p. 335.

1849. *Silurus wallagoo*, Jerdon, *ibid.*, p. 333.

1850. *Silurus Mulleri*, Bleeker, *Verh. Bat. Gen.*, xxiii, p. 10.

1852. *Wallago Mulleri*, Bleeker, *Nat. Tijdschr. Ned. Ind.*, iii,

1853. *Wallago Russellii*, Bleeker, *Verh. Bat. Gen.*, xxv, p. 108.

1858. *Wallago Russellii*, Bleeker, *Ichth. Arch. Ind. Prodr.*, i, *Siluri*, p. 261.

1858. *Wallago Russellii*, Blyth, *Journ. As. Soc. Bengal*, xxvii, p. 283.

1859. *Wallago Russelli*, Bleeker, *Nat. Tijdschr. Ned. Ind.*, xx, p. 102.

1862. *Wallago attu*, Bleeker, *Atl. Ichth.*, ii, p. 79, pl. lxxxvi, fig. 1.

1864. *Wallago attu*, Günther, *Cat. Fish. Brit. Mus.*, v, p. 36.

1877. *Wallago attu*, Day, *Fish. India*, p. 479, pl. cxi, fig. 4.

1889. *Wallago attu*, Day, *Faun. Brit. Ind. Fish.*, i, p. 126, fig. 54.

1890. *Wallago attu*, Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova* (2), ix, p. 199.

1913. *Wallago attu*, Weber and de Beaufort, *Fish. Indo-Austral. Archipel.*, ii, p. 201.

1916. *Wallago attu*, Raj, *Rec. Ind. Mus.*, xii, p. 263.

1923. *Wallago attu*, Hora, *Journ. Nat. Soc. Siam* (2), vi, p. 165.

1929. *Wallago attu*, Prashad and Mukerji, *Rec. Ind. Mus.*, xxxi, p. 175.

1932. *Wallago attu*, Deraniyagala, *Ceylon Journ. Sci.* (B), xvi, p. 275, pl. lv.

1934. *Wallago attu*, Fowler, *Proc. Acad. Nat. Sci. Philadelphia*, lxxxvi, p. 87.

Vernacular names:—*Boyali* and *Keyali* (Dinajpur); *Boali* (Rungpur); *Boyari* (Bhagalpur and Patna); *Barhari* (Gorakhpur); *Shivada, Pari, Purram* and *Worshoorah* (Mahratta); *Valai, Alhi Yalai, Wallah* and *Tele* (Tamil); *Boallee* (Hind.); *Ballia* and *Boalee* (Uriya); *Mulley* (Punjab); *Poikee Mulla, Pi-i-kee* and *Jer-i-kee* (Sind); *Walagah* (Telugu); *Maha Valeya* and *Valeya* (Sinhalese); *Sareng* (Manipur, Assam); *Poil* (Chittagong); *Nga-bat* (Burma); *Gwalli, Bawali, Latchi, Laki* and *Bawari* of Trihut; *Lanch* and *Lanchi* of Deoli, *Baralie* of Assamese; *Painda* of Rohtak.

Sanskrit names:—*Sahasradanshtra, Pathina Rupyabarna, Udaradirgha* and *Mahasira*.

B.18-21; D.5; A. 86-93; P.1/13-15; V. 10; C. 17.

The large head is the most conspicuous part of the fish; it increases in size considerably during the growth of the fish and its length is contained from 4.2 to 4.7 times in the standard length. The depth of the body is contained from 5 to 7 times in the standard length. The eyes are small and are situated entirely above the mouth opening; the hinder border of the eye is about one diameter in front of the posterior extremity of the cleft of the mouth. The diameter of the eye is contained from 6.5 to 10 times in the length of the head. The snout is spatulate and somewhat produced. The lower jaw is slightly longer. The maxillary barbels are twice as long as head, and extend to the anterior part of anal; the mandibular barbels are as long as snout. There are broad bands of depressible, pointed teeth in the jaws; those of the posterior rows increasing in size. The vomerine teeth are similar and are situated in two oval patches. The lateral line is well marked. There are 21 short gill-rakers.

The dorsal fin is short, spineless and is situated in the anterior third of the body length; its height is more than the postorbital part of the head. The anal is separated from the caudal. The pectorals are about two-thirds the length of the head; the spine is entire and feeble with the stiff portion as long as the postorbital part of the head. The caudal fin is forked and the lobes are rounded. The colour is more or less uniform, somewhat darker above and lighter below. The fins are sometimes covered with fine dots.

Hamilton (4) described the colouration as follows:—

> 'Above it is of an olive *shade* with a golden gloss, and below white with clouded spots, consisting of numerous black dots; but the vent and tail fins are blackish, and over the whole fish is spread a livid hue, which rapidly increases after it is taken out of the water, and soon covers the whole.'

In a fresh specimen from a Calcutta market purchased in May 1938 the dorsal surface was found to be light elm green, while the sides were of a cream colour, lighter below and darker above. Along the lateral line there was a faint band of light orange yellow. The operculum was light purple, while there was a patch of light blue behind the eyes. Along the dorsal margin of the eyes there was a band of burnt sienna colour. Above the pectorals there were patches of light indigo which faded upwards into whitish areas. Along the base of the anal fin the colour was light vermilion. The barbels were light yellowish white. The paired fins were of a light yellowish vermilion colour, while the anal and the caudal were of reddish neutral tint. The dorsal fin was marked with a yellowish neutral tint.

The air-bladder is heart-shaped and is attached to the bodies of the second to the fourth vertebrae.

Distribution:—*Wallagonia attu* is found throughout India, Ceylon, Burma, Siam, Java, Sumatra and Western Yunnan. This is the only species of the genus found in Indian waters. In the material examined it has not been possible to differentiate local races or varieties, but as a rule in the Burmese and Siamese specimens the eyes are proportionately smaller.

Measurements in millimetres.

	Bangkok, Siam	Burma	Myitkyina Dist., Burma	Rajmahal Hills, Bengal	Calcutta	Motihari, Bihar	Barabanki U.P.	Deoli, C.P.	Gonda C.P.	Travancore
Total length excluding caudal ...	445·0	171·0	360·0	101·5	445·0	190·0	251·5	180·0	296·5	383·0
Length of head	98·0	39·0	82·0	24·0	92·5	42·7	55·0	40·0	62·0	80·5
Width of head	56·5	14·0	49·0	12·5	45·5	24·0	33·0	20·0	30·0	48·0
Width of body	45·5	12·0	37·0	10·0	44·0	16·5	25·0	14·0	24·5	47·5
Depth of body	70·0	24·5	65·0	16·5	76·5	29·0	41·0	29·0	45·0	70·0
Diameter of eye	13·0	6·5	11·0	4·0	13·0	7·0	8·0	7·0	10·5	11·5
Interorbital width	42·5	13·0	35·0	8·0	37·5	16·0	22·0	14·0	21·5	34·0
Length of snout	42·0	14·5	33·0	9·0	38·5	16·0	22·0	14·0	25·0	31·5
Length of dorsal fin	57·0	19·0	53·0	14·0	59·0	25·0	31·0	20·5	38·5	Damaged
Length of pectoral fin	59·0	19·0	52·0	13·0	61·5	27·0	32·0	25·0	41·0	56·3
Length of maxillary barbel ...	192·0	80·0	161·0	37·0	184·5	72·0	100·0	87·0	47·0	117·5
Length of mandibular	24·0	12·0	27·0	8·0	32·5	Damaged	19·0	15·5	18·0	23·5

BIONOMICS AND FISHING NOTES.

In the introduction reference has been made to the general habits of the species and the types of localities inhabited by it. Sundara Raj (**10**) noted that

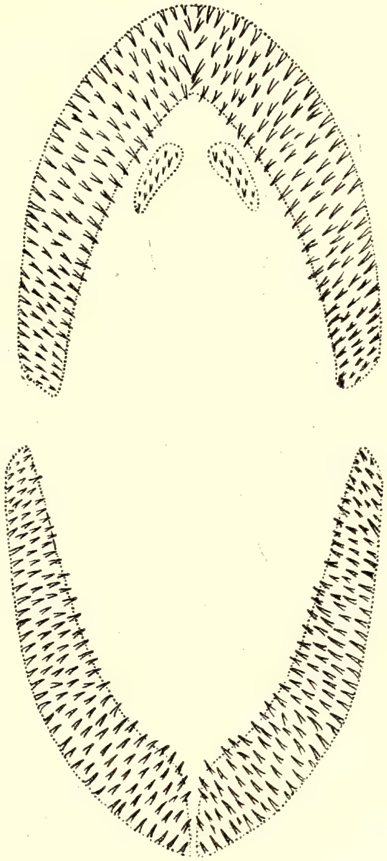
> '*W. attu* is a large and powerful fish and predaceous in habits. It feeds on both vegetable and animal matter, preferably on the latter, and is said to destroy fry and large numbers of smaller fish in ponds. It is sluggish in its movements and lives for the most part at the bottom. Thomas attributes the frequent slowness of this fish to discover the presence of food to deficient sight. The statement that it feeds mostly at night appears to be incorrect, as I have seen it active and freely take a bait by day. It is usually caught in large nets and when handled it makes fierce attempts to bite.'

Its formidable rows of teeth (text-fig. 1), all of which are directed backwards, are not meant for mastication or for tearing the prey, but to prevent its escape once it is inside the mouth. The teeth are so effective that Thomas (**11**) warns anglers not to thrust their fingers inside the mouth to take out the hook. He observes that

> 'However dead the fish may seem, never dream of attempting to take out your hooks without securing yourself against his closing his awful jaws on you, by firmly wedging his mouth open with a log, or stone, or gag. And a disgorger will be found useful.'

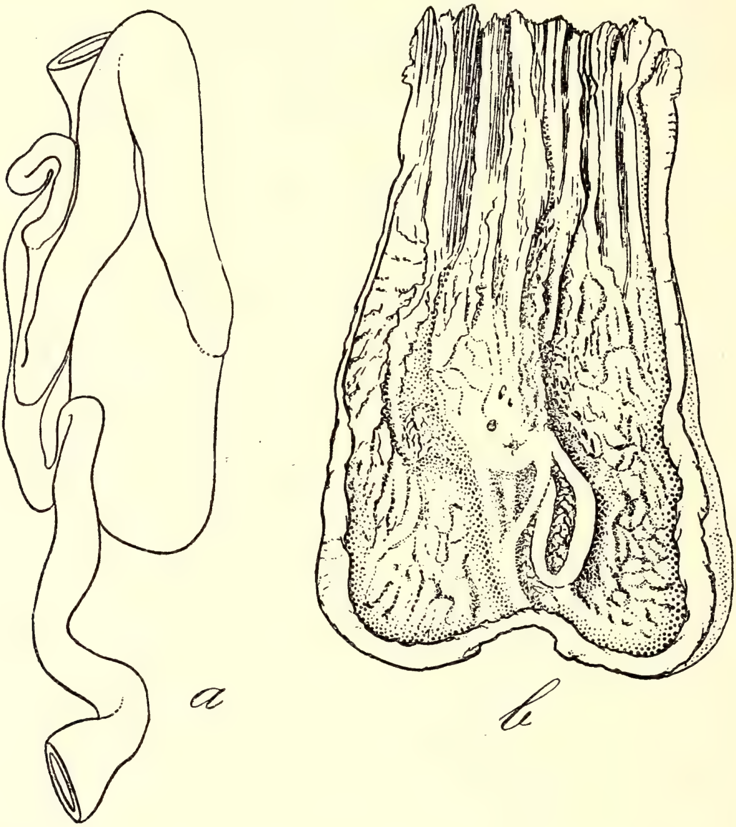
The predaceous habit of the fish is also evident from the nature of its alimentary canal (text-fig. 2*a*) which is only slightly convoluted. The stomach is a large, bag-shaped structure the walls of which are greatly folded internally (text-fig. 2*b*).

These structures indicate that the fish feeds mostly on animal matter and on living organisms. There seems hardly any doubt that during its search for prey the sense of sight plays very little part and that its tactile feelers are the main agency for the fish to feel its way in the muddy waters in which it lives.



Text-fig. 1.—Upper and lower dentition of a specimen of *Wallagonia attu* (Bl. and Schn.), 302 mm. in standard length. ×1½.

According to Beavan (**1**), *W. attu* is 'a remarkably good fish for eating purposes, when taken from clean waters, and is much in request among the natives. In Sylhet they capture it by spearing from a boat rowing slowly up stream and coming behind the fish. This would seem to indicate that it is not a bottom feeder like many of the Siluridae.' Beavan's inference that the fish is not a bottom feeder will be contested by all anglers. For instance Dhu (**3**) gives the following method of catching it :—



Text-fig. 2.—Alimentary canal of *Wallagonia attu* (Bl. and Schn.).

a. Alimentary canal of a specimen 302 mm. in standard length. × 1½ ; *b.* Stomach of a specimen 464 mm. in standard length cut open to show the structure of its inner walls. × 1½.

> 'A stout hand line with a dead fish on the hook, weighted and thrown into the tank bed in the evening, is sure to take in one of these monsters who will give plenty of sport. Young fish from 5 to 15 lbs. can be taken at any time of the day with a stout pike or Salmon rod and light tackle spinning with a small fish or a 1½ inch spoon.'

Thomas (**11**) also suggests 'pike or Salmon rod, and spinning with a small fish the size of your forefinger, or even with a small 1½ inch spoon. With such light tackle they give excellent sport.' He advocates the use of wire in preference to gimp or gut while fishing for this species, According to Dhu, the *Mulley* 'Takes fly, spoon and spinning bait sometimes in rivers, also occasionally rises to fly in tanks, greedy as regards live bait. Fights fairly well and is not bad eating. Takes worms and occasionally paste in tanks. Also frequently springs out of water when hooked.'

Lacey (**6**) gives a good account of the species from an angler's point of view and suggests that best fishing can be had in warm season and on warm days.

ACKNOWLEDGMENTS.

The Bombay Natural History Society very kindly made a grant towards the cost of the illustrations, and for this I offer my sincere thanks to the authorities of the Society. Mr. K. S. Misra helped me with the preparation of the table of measurements, and for this I am indebted to him. The illustrations were prepared by Babu B. Bagchi with his usual skill and care under my supervision.

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EXPLANATION OF PLATE.

Colour sketch of the lateral view of a specimen of *Wallagonia attu* (Bl. and Schn.), 464 mm. in standard length. It was purchased from a Calcutta market in fresh condition.

THE EARLY STAGES OF INDIAN LEPIDOPTERA.

BY

D. G. SEVASTOPULO, F.R.E.S.

PART III.

(*Continued from Vol.* xl, p. 692).

RHOPALOCERA.

PIERIDÆ.

Delias descombesi Bsd., *leucacantha* Fruhs.

Pupa—Head produced into a point, forked at the end and shaped rather like a T. Thorax with a large keel. Abdomen with six stout black spines along the dorsum, the first and second curved backwards. Three subdorsal blunt black spines above the edge of the wing case, the central one largest. Colour of head and thorax blackish brown; abdomen whitish dorsally, brownish laterally with a series of white dots; wing cases black with yellow veins; antenna sheaths black ringed with yellow. Attached to a leaf by the cremaster and rather a long girdle of white silk.

Described from a batch of seven pupae found on one leaf in Shillong 15-vii-38, from one of which a female emerged 16-vii-38.

NYMPHALIDÆ.

Ergolis merione Cr., *tapestrina* Moore.

Bingham, *Fauna Brit. Ind.*, Butterflies, i, 462. 1905.

Head flattened frontally, very dark brown marked with whitish, and produced above into a pair of straight red-brown spinous horns. Body green with a fawn dorsal stripe, edged with dark brown, from 1st to 11th somite. A subdorsal series of short branched spines from the 2nd to the 12th somite, the 10th and 11th somites each with an additional dorsal spine. A lateral and sublateral spine on the 2nd and the 3rd somite, and a lateral and two sublateral on each somite from the 4th to the 10th. 11th somite with a lateral spine only. Legs and prolegs green.

Another form is without the dark edged, fawn dorsal stripe.

Pupa—Head bifid. Wing cases slightly dilated. Thorax keeled. A slight prominence on the 3rd abdominal somite. Colour pale purplish brown, the sides of the meta-thorax and the abdominal prominence rather darker. A median heart-shaped dark brown mark on the 5th abdominal somite. Wing cases with a faint reticulated pattern and a fairly distinct antemedian and median dark line. Antenna cases dark brown. Attached by the cremaster below a leaf of the food-plant.

Food-plant—Castor (*Ricinus communis* Linn.).

Described from a full fed larva found in Calcutta 17-i-39, pupated 19-i-39, and a female emerged 27-i-39.

Bingham, quoting Moore, describes the larva as 'Cylindrical, slender; segments armed with two dorsal and two lateral rows of short-branched spines; head with a pair of long, straight, branched spines. Colour green with dorsal longitudinal dark brown lines.'

HETEROCERA.

ZYGAENIDÆ.

Erasmia sanguiflua Drury.

Head dull dark brown, retractile. Ground colour dark brown. 7th and 8th somites each with a white transverse dorsal band. A subdorsal series of tubercles, those on the 7th and 8th somites yellow the others brown, bearing paired brown bristles. A sublateral series of similar tubercles, those on the first three somites brown the others deep pink, with longer yellow bristles. Prolegs deep pink. Venter pinkish.

Cocoon of very pale yellowish brown papery silk. Spun in a folded leaf.

Described from a full fed larva found in Shillong 14-vii-38, spun 2-viii-38, and a female emerged 22-viii-38.

ARCTIIDÆ.

Pericallia ricini F.

Moore, *Lep. Ceyl.*, ii, 70, pl. 106, fig. 2b. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, ii, 18. 1894.

Head black, mouth parts marked with white. Ground colour dark grey. A pale yellow dorsal stripe blotched with dull orange. A double yellowish lateral line joining together between the somites. Hairs grey tipped with whitish. Legs black. Claspers marked externally with black, the feet orange.

The immature larva is similar but the ground colour is pale greenish grey and there is a black subdorsal spot on the 2nd and 12th and a dark grey subdorsal spot on the 4th and 10th somites.

Pupa dark purplish of typical Arctiine shape. In a double thin hammock-shaped cocoon of brown silk mixed with larval hairs.

Food-plant—I have bred it on Sunflower and Castor, whilst Moore records Notonia, Fagraea and Dahlia. There are probably few herbaceous plants that it will not eat.

Very subject to the attacks of parasites, out of a batch of seven larvae four were ichneumoned.

Described from a full fed larva found in Calcutta 26-vi-38, pupated 29-vi-38, and a female emerged 27-vii-38.

Moore's description, which is more or less copied by Hampson, is 'Larva dark brown, white speckled; with dorsal and lateral tufts of fine hairs,' *Nyctemera plagifera* Wlk.

Head red brown with a few black hairs. 1st somite red brown, ground colour of the rest of the body black. A broad white dorsal stripe, interrupted between the somites, and with one broad and two narrow transverse black lines on each somite from the 5th to 11th. A broken white lateral stripe. 2nd somite with subdorsal pencils of long black hair, pointing forward and having the appearance of antennae. Rest of the body with rosettes of black hair. Venter blackish. First pair of legs red brown, the others black. Claspers reddish brown.

Pupa in a thin cocoon of white silk. Pale chestnut in colour, abdominal somites with a subdorsal, lateral and latero-ventral series of black spots. Thorax with two subdorsal black spots. Leg, antenna and wing cases streaked with black.

Food-plant—A species of Compositae.

Described from a full fed larva found in Shillong 22-vii-38, pupated 27-vii-38, and a male emerged 5-viii-38.

LYMANTRIIDÆ.

Dasychira complicata Wlk.

Head orange. Ground colour orange brown, a white dorsal line edged with black from the 8th to 10th somite. First three somites rather greyer and marked with reddish intersegmentally. 10th somite with two sublateral short white streaks. Very elaborately haired. 1st somite with subdorsal, lateral and sublateral tufts of greyish hair forming a fringe. 2nd somite similar, 3rd somite in addition with a slender subdorsal pencil of very long white hairs. 4th to 7th somites each with a double dorsal fan-shaped brush of fairly long golden hair and a similar brush on the 11th somite. 4th to 11th somites with lateral warts giving rise to tufts of golden hair and a series of similar sublateral warts. 8th to 10th somites with subdorsal warts bearing short whitish hairs. Anal somite with a pencil of a few long white hairs. Venter black. Legs and prolegs crimson. The larva has the appearance of having been compressed laterally.

Pupa pale chestnut brown, the dorsum densely clothed with golden brown hair about an eighth of an inch long. In a double cocoon of whitish silk mixed with larval hair.

Food-plant—Various, found on Apple, Bracken and Montbretia, it also ate *Lagerstroemia indica* Linn. in captivity.

Described from a full fed larva found in Shillong 25-vii-38, spun 29-vii-38, and a female emerged 17-viii-38.

LASIOCAMPIDÆ.

Lebeda nobilis Wlk.

Ovum barrel-shaped, whitish with a dark spot at each end and three olive brown rings, the central one being the most prominent.

Larva—Head dark brown with a paler streak on each side and clothed with short hair. Ground colour varying from dark blue grey to pale silver grey, some examples being plain and others mottled. The whole body is clothed with small scale-like hairs, which give it a speckled appearance. 1st somite with a dorsal fringe of short buff coloured hair projecting forward over the head, a subdorsal tubercle bearing a fringe of long buff coloured spatulate hairs and a lateral tubercle with a fringe of similar hairs. 2nd to 11th somites each with a lateral tubercle, those on the 2nd and 3rd being largest, bearing a fringe of long buff coloured spatulate hairs. 2nd and 3rd somites each with a transverse dorsal fold lined with dark skin and fringed internally with bright red-brown blue-tipped sharp pointed hairs and externally with short buff coloured hairs. 5th to 11th somites each with a subdorsal brush anteriorly, consisting of the sharp red-brown blue-tipped hairs covered by a layer of ribbon-like buff coloured hairs. When the larva is in repose the dorsal folds are closed and the brushes lie flat along the dorsum, the appearance then matches a piece of bark or dead stick. When alarmed the folds are opened and the brushes erected, revealing the sharp pointed hairs, and any attacker is bound to run into them. Legs reddish. Claspers marked with reddish. Venter black with a dark red lateral stripe.

Pupa in a dense cocoon of blackish brown silk, usually spun in a leaf, through which the red-brown larval hairs are pushed point outwards. Dark purple in colour with the intersegmental areas dark chestnut. Abdominal somites with a short fringe of golden brown pubescence.

Food-plant—Pine, Bracken, *Rubus* sp., and probably many others.

Described from a number of full fed larvae found in Shillong, one of which spun 28-vii-38 and a male emerged 1-ix-38.

Metanastria latipennis Wlk.

Grunberg Seitz, *Indo-Austr. Bombyces*, x, 395.

Ovum barrel-shaped. Chalky white with a large olive green spot on each side. Micropyle dark.

Larva—Head very dark brown with an inverted white Y mark, the area between the arms almost filled in with white. Ground colour of body dark golden brown dotted with black. Dorsal and lateral areas thickly covered with longish pale-tipped dark hair, that on the dorsum growing more or less in tufts, that on the sides in a fringe. 4th to 9th somites each with a short subdorsal and lateral tuft of dark reddish brown hair. Legs reddish brown. Claspers with a double white stripe externally. Venter very dark brown. One example had tufts of bright yellow hair among the dark hair of the dorsum and sides.

Pupa dark purple brown, the intersegmental areas paler. The thorax and abdomen sparsely clothed with very short golden brown pubescence. Enclosed in a thick cocoon of very dark brown silk, usually spun in a leaf, through which the larval hairs are pushed point outwards.

Described from a full fed larva found in Shillong 18-vii-38, pupated 26-vii-38, and a female emerged 30-viii-38.

The description in Seitz is as follows:—'Larva at the thorax with dense long, lateral hairing, on the abdomen with basal lateral and dorsal hair-tufts of light and dark hair. Pupa on the broadly obtuse anal end with a corona of bristles.'

BOMBYCIDÆ.

Andraca bipunctata Wlk.

Head paler or darker brown. Ground colour varying from greenish yellow to darkish brown. The 3rd and 4th somites expanded laterally into a triangular lobe. 11th somite with a longish curved fleshy horn, the end of which curls and uncurls. Body clad with very short sparse hairs, only visible under a lens. 2nd to 10th somites each with a dark subdorsal wart bearing a black bristle. A dark dorsal and lateral line from the 1st to the 4th somite. A dark line starting from the subdorsal wart on the 4th somite, running through the spiracles of the 5th, 6th and 7th somites and then along the anterior margin of the proleg on the 8th somite. Above this line there is a paler area and there is a pale stripe along the side of the proleg on the 8th and 9th somites. An oblique stripe on the 8th-9th, 9th-10th and 10th-11th somites. In some examples the dorsum is slightly mottled. Horn rather darker in colour and there is a dorsal dark stripe running from its base to the apex of the anal flap. Legs, prolegs and venter varying with the ground colour.

Pupa in a small cocoon of brown silk, spun along a twig or in a tuft of leaves. Dark purple in colour, somewhat pitted. The end of the abdomen truncate.

Described from a number of full fed larvae found in Shillong, one of which spun 22-vii-38, and a female emerged 3-viii-38.

SATURNIIDÆ.

Cricula trifenestrata Helf.

Moore, *Lep. E.I. Co.*, pl. 18, figs. 7a, 7b. 1857-59.

Hamps., *Fauna Brit. Ind.*, Moths, i, 28. 1892.

Seitz Seitz, *Indo-Austr. Bombyces*, x, 507.

Head crimson with a few white hairs. Ground colour black sprinkled, except between the somites, with yellow green dots. 1st somite with a crimson dorsal patch. A transverse series of six small crimson tubercles on each somite, bearing short stinging bristles. A yellow green sublateral stripe. Anal flap, legs, prolegs and a stripe along the venter crimson. The body is clothed with medium length white woolly hair. Gregarious.

Pupa golden fawn, sprinkled with minute black dots. Intersegmental areas darker. Wing cases suffused with blackish. Cocoon shuttle-shaped of bright golden yellow silk, not altogether net-like but with a fair number of holes.

Described from a full fed larva found in Shillong 13-vii-38, spun 15-vii-38, and a male emerged 9-viii-38.

My larvae were very different from those described by Hampson and Seitz. The former's description is 'Larva black brown; 2nd to 11th somites each with six setiferous tubercles; 1st somite and claspers crimson; a pale reddish sublateral stripe; legs and prolegs brown.' Seitz writes 'The larva distantly resembles that of *Lasiocampa quercus*; it has a yellowish brown fur, dark ring—indentations, each ring with 6 tufted small tubercles; neck and anal shield reddish, legs red brown.'

LIMACODIDÆ.

Oxyplax ochracea Moore.

Moore, *Lep. Ceyl.*, ii, 129, pl. 129, fig. 3a. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, i, 376. 1892.

Hering Seitz, *Indo-Austr. Bombyces*, x, 719.

Shape oval, flattish. Head dark brown, retractile. Body dark brown with a pale dorsal and pale transverse lines. A yellow saddle-shaped mark slightly behind the centre of the body, wide at the sides and narrow on the dorsum. Anterior part with four subdorsal, the first one pointing forward, and three lateral brown spined scoli. Median part with three subdorsal tufts of short yellow spines and four very small lateral yellow spined scoli. Posterior part with two subdorsal and three lateral brown spined scoli.

Cocoon dark red brown, almost spherical.

Food-plant—Found on Apple, but ate the leaves of a number of shrubs in captivity.

Described from a full fed larva found in Shillong 12-vii-38, spun 15-vii-38, and a male emerged 5-viii-38.

All three descriptions mentioned above refer to a pale green larva, whitish above, with two dorsal rows of black spots, a black dorsal patch on the second segment and a single spot on the anal one. Both Hampson and Hering appear to have copied Moore's description of a Ceylon larva, the wording of the three descriptions being almost identical.

NOTODONTIDÆ.

Nadata niveiceps Wlk.

Head large, slightly triangular, pale bluish green dotted with white at the sides and with a double white central stripe. Ground colour of body white, except the first three somites which are pale bluish green. A series of seven subdorsal oblique green stripes from the 4th to the 10th somite, the last meeting dorsally on the 11th somite, which is humped. Spiracles consisting of a yellow line surrounded by a dark red and a white ring. Legs yellow green. Prolegs and venter bluish green. Anal flap very large and with a raised reddish brown margin.

Pupa, in captivity, formed in a slight cocoon among litter. Very dark purple, almost black. Minutely pitted. In shape blunt at both ends and with the divisions between the abdominal somites very deeply cut. Cremaster a transverse row of six slightly hooked spines with two more immediately behind them on the dorsum.

Food-plant—*Quercus* sp.

Described from a full fed larva found in Shillong 18-vii-38, pupated 24-vii-38, and a female emerged 17-viii-38.

Phalera parivala Moore.

Head pale brown spotted with black. Ground colour very pale yellow, changing to bluish white when completely full fed. A black sublateral stripe throwing out a branch on each somite, those on the 1st to 4th almost erect and on the 5th to 11th slightly more oblique. A broken double black dorsal line from the 1st to the 3rd somite, where it joins together and terminates. 11th somite with a pale orange transverse dorsal band, edged with black and with three black spots on it. 12th somite laterally and anal flap yellowish spotted with black. Legs black. Prolegs black with two rings of the ground colour. Venter black with a bluish central stripe from the 1st to the 9th somite. Each somite with a subdorsal tuft of a few long white hairs and with a few more laterally and sublaterally.

Pupa subterranean in an earthen cocoon. Purplish black. Rather long. Cremaster consisting of four short spines between two teeth.

Food-plant—*Lespedeza Thomsoni* Benth. (Leguminosae).

Described from a full fed larva found in Shillong 8-vii-38, buried itself 10-vii-38 and a male emerged 27-vii-38.

Desmeocraera fasciata Moore.

Head bluish green. Ground colour green. 1st somite with a pale yellow collar behind the head, bilobed subdorsally. 8th to 10th somites each with a dorsal fawn blotch. 11th somite with a short fawn dorsal stripe posteriorly, joining a transverse blotch on the 12th somite. Legs red, ringed with pale yellow at the base. Prolegs and venter green. Spiracles red. The fawn markings fade and the ground colour becomes purplish prior to pupation.

Pupa subterranean in an earthen cocoon. Smooth, dark purplish brown. Prothorax with a pair of short subdorsal tubercles. Cremaster broad with six small teeth.

Food-plant—*Quercus* sp.

Described from a full fed larva found in Shillong 8-vii-38, pupated 13-vii-38, and a female emerged 29-vii-38.

NOCTUIDÆ.

Brithys crini F.

Moore, *Lep. Ceyl.*, iii, 14, pl. 145, fig. 2a. 1884-87.

Hamps., *Fauna Brit. Ind.*, Moths, ii, 168. 1894.

Warren Seitz, *Indo-Austr. Noctuidae*, xi, 85.

Head orange buff with two large black spots. Ground colour black, 1st somite with an orange buff dorsal blotch with two black spots. Each somite with five large white spots on the posterior edge and five slightly smaller spots on the anterior. A few short bristly hairs. Anal somite and claspers orange buff spotted with black. Legs black. Venter blackish.

Pupa subterranean. Very dark purple, almost black, with the intersegmental areas paler.

Food-plant—Amaryliideae and, according to Seitz, Liliaceae.

Described from a full fed larva found in Shillong 28-vii-38, buried itself 31-vii-38, and a female emerged 8-viii-38.

Moore's description, which is more or less copied by Hampson, is 'thick, warty; second to eleventh segments black, spotted with bluish white; head, top of second segment, and the two anal segments red, with black spots; legs red; forelegs black tipped.' Seitz's description is 'Larva with the head, the second and last segments, and the legs yellow; the rest brown, with dorsal and subdorsal series of yellowish white spots.'

Calogramma festiva Don.

Semper, *Schmett. Philippines*, 516, pl. Q, figs. 4 & 5.

Warren Seitz, *Indo-Austr. Noctuidae*, xi, 320.

Head black with a dark brown inverted Y-shaped mark. Ground colour grey, 1st somite with a darker dorsal blotch. A yellow dorsal stripe, a white dorso-lateral stripe, with a series of black streaks above it and with an irregular double white line between it and the dorsal stripe. A white lateral line with an irregular white line between it and the dorso-lateral stripe. A yellow sublateral stripe with a series of black blotches above it. 4th somite with a transverse black band, straight in front and curved behind, between the dorsal and sublateral stripes. Anal plate black. Legs black. Prolegs purplish marked with black externally. Venter purple.

Pupa subterranean in an earthen cocoon. Mahogany brown, wing cases and thorax slightly darker.

Food-plant—Liliaceae. Feeds gregariously.

Described from a full fed larva found in Calcutta 4-viii-38, pupated 7-viii-38, and a male emerged 15-viii-38.

Seitz's description which is based on Semper's, is 'Larva brown with black and white irrorations, a black band on 5th segment; dorsal and subdorsal lines whitish; stigmata with white spots defined by black above and with a broad yellow band below them; head and ventral surface redbrown.'

Acontia transversa Guen.

Moore, *Lep. Ceyl.*, iii, 42, pl. 149, fig. 2a. 1884-87.

Hamps., *Fauna Brit. Ind.*, Moths, ii, 323. 1894.

Head green with a few pale hairs. Body green. Each somite with a subdorsal pair of oval rust coloured spots. Very slightly darker green oblique lateral stripes. A pale spiracular line. A few scattered hairs. Legs green. Prolegs green, the first two pairs completely obsolete. Venter silvery green. Turns purple just prior to pupation.

Pupa, in captivity, in a slight cocoon between two leaves. Abdomen dark chestnut with a darker dorsal stripe. Thorax very dark chestnut. Wing cases dark olive green. Cremaster two diverging spines.

Described from a full fed larva found in Shillong 25-vii-38, pupated 29-vii-38, and a female emerged 9-viii-38.

Hampson's description, which is more or less copied from Moore, is 'Larva pale green, with a few very fine hairs; subdorsal, lateral and sublateral series of white spots, the subdorsal series with a larger yellow spot on each somite.' Moore's figure shews a plain green larva with a series of yellow subdorsal spots and a broad white sublateral stripe, this latter is not mentioned in the text. He describes and figures the larva as having twelve legs, but Hampson, in his description of the genus, writes 'Larva with four pairs of abdominal prolegs'; the word 'pairs' should obviously be omitted. Moore calls the pupa pale purplish red, Hampson pale pinkish red.

Hypocala deflorata F.

Head brown. Ground colour black. 1st somite with an orange dorsal blotch marked with black. 4th somite with a deep yellow transverse dorsal band anteriorly. 11th somite with a similar orange band. Anal somite marked dorsally with orange. Three white subdorsal lines, interrupted by the yellow and orange transverse bands, and three sinuous white lateral lines. An orange spiracular stripe and a very broken yellow subspiracular stripe, most noticeable on the 10th somite. Legs black. Prolegs pale with a black shield-shaped mark externally. Venter blackish with a pale median line and the area between the prolegs pinkish. Spiracles white ringed with black.

Pupa subterranean in a slight earthen cocoon. Chestnut brown, with wing cases slightly paler. Rather slender in shape. Cremaster two long and two short spines.

Described from a full fed larva found in Shillong 15-vii-38, buried itself 16-vii-38, and a male emerged 2-viii-38.

Cosmophila mesogona Wlk.

Head yellowish green. Ground colour yellowish green, a darker dorsal and lateral stripe. 1st somite with two transverse rows of six white-ringed black dots immediately behind the head. 2nd and 3rd somites each with a median row of eight similar dots and with a lateral pair, one in front of and one behind the median series. 4th to 12th somites each with two subdorsal and three lateral white-ringed black dots. Legs and prolegs each with a white-ringed black dot at base. Some of these dots give rise to a single black hair. Legs green. Prolegs green, the first pair obsolescent.

Pupa dark purplish, rather slender. Between two spun together leaves.

Described from a full fed larva found in Shillong 9-vii-38, spun up 10-vii-38, and a male emerged 25-vii-38.

Cosmophila fulvida Guen.

Moore, *Lep. Ceyl.*, iii, 85 & 86, pl. 155, figs. 2a, c, d & 3a. 1884-87.

Hamps., *Fauna Brit. Ind.*, Moths, ii, 410. 1894.

Head green marked on the vertex with crimson, slightly hairy. Ground colour green. A pale dorsal line, edged on each side with darker, a yellow dorso-lateral line and a very thin white lateral and sublateral line. 1st somite with two transverse series of six white-ringed black dots, each giving rise to a short bristle. 2nd and 3rd somites each with a series of eight similar dots and with an extra two, one anterior and the other posterior to the transverse series, sublaterally. 4th to 11th somites each with four similar dots subdorsally, two on each side of the dorsal line, and with a lateral series of three in the form of a triangle with the apex forward. 12th somite with four subdorsal but only one lateral dot. A similar dot just above the origin of each leg and proleg. Legs green. Prolegs green with pink feet, the first pair partially aborted. Venter green.

Pupa in a slight cocoon between leaves. Dark purplish, rather slender.

Described from a full fed larva found in Shillong 12-vii-38, pupated 14-vii-38, and a female emerged 29-vii-38.

The larva is apparently very variable. Moore, whose description is copied by Hampson, giving the ground colour as black, olive green and olive grey. All my larvae, however, were as described above. Moore gives the food-plant in Ceylon as '*Waltheria indica*, etc.'

GEOMETRIDÆ.

Biston bengaliaria Guen.

Head flattened and bilobed, mottled brown with a darker central blotch. 1st somite bilobed. Ground colour brownish, blotched and mottled with darker, resembling a dead and slightly lichen covered twig. 8th somite with a lateral white wart.

Pupa subterranean. Dark purplish, minutely pitted. A raised ridge on the thorax at the origin of the wing cases. Cremaster long and ending in a sharp spine. Last somite with a pair of short spines ventrally.

Described from a full fed larva found in Shillong 9-vii-38, buried itself 11-vii-38, and a male emerged 4-viii-38.

THE BIRDS OF CENTRAL INDIA.

BY

SALIM ALI.

WITH NOTES BY HUGH WHISTLER.

PART I.

(*With a map*).

This paper is based on a collection of 886 birds made during 1938, and on field work lasting aggregately six months—January to April and August to September—in the Central Indian States of Bhōpal, Gwālior, Indore and Dhār. The Survey was made possible by the generosity of the Durbars concerned to whom the thanks of the Society and of all ornithologists are due.

The area here dealt with had not, as a whole, been systematically worked before. The bibliography at the end gives an idea of the comparative meagreness of our previous knowledge. While no novelties were to be expected, it was desirable to obtain fresh material in order to determine the races that occur, and for generally bringing Central India up in line with other areas that have been systematically investigated within recent years. Only a more or less bald list of the birds met with is here given, with short remarks on status, etc. Owing to pressure of time I have had to discard my usual practice of collating all previous records under one comprehensive paper.

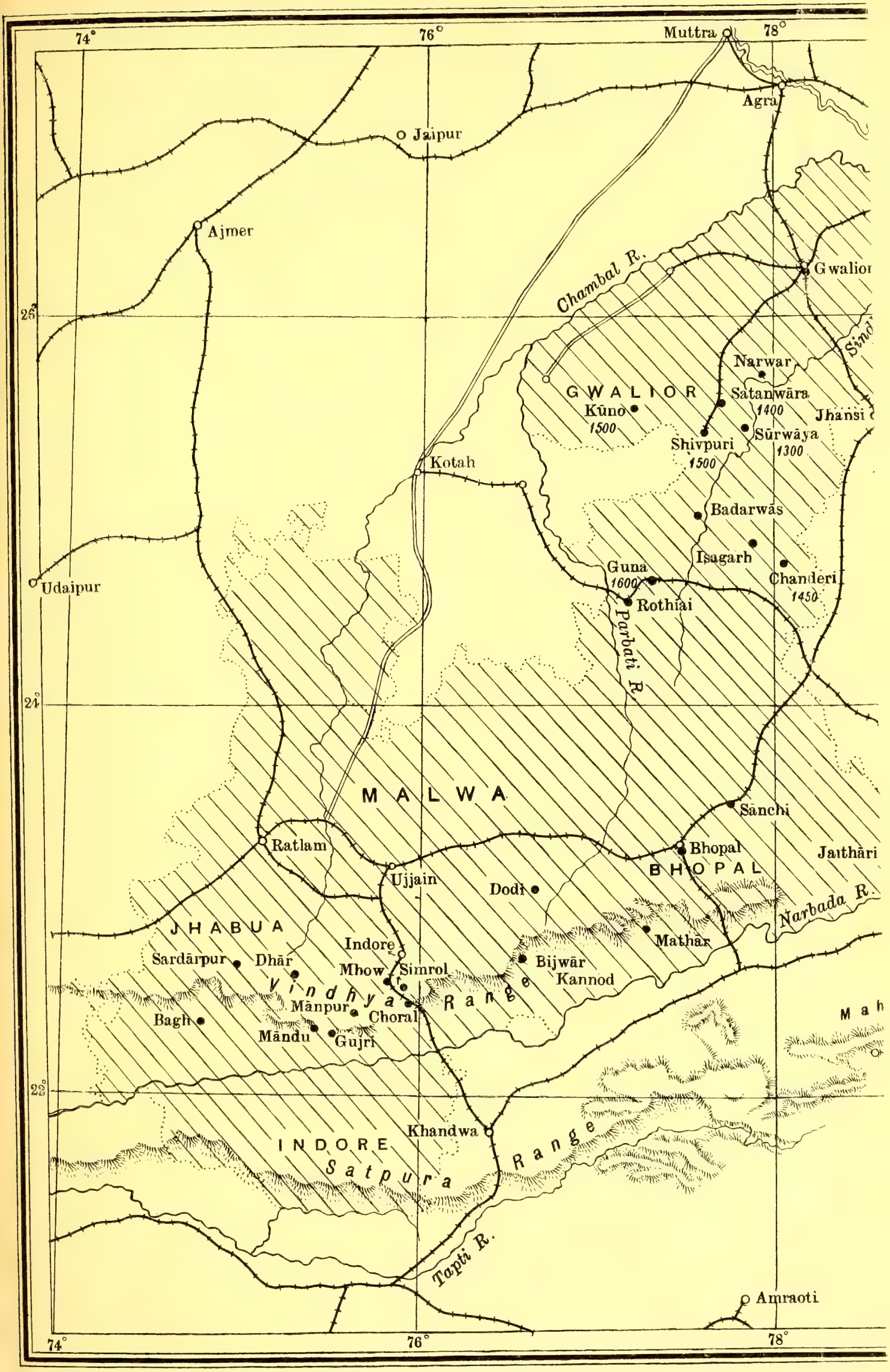
As in my earlier regional papers, Mr. Hugh Whistler is responsible for the useful taxonomical notes which appear in square brackets. His painstaking research and constant collaboration have added considerably to the usefulness of this work, and I am deeply grateful to him.

PHYSIOGRAPHY

Of the total area of 78,772 square miles covered by Central India, the four States here dealt with occupy 43,218 as follows: Gwālior 25,041; Bhōpal 6,902; Indore 9,500; Dhār 1,775. From the physiographical point of view they may be considered fairly representative of the whole, and this is doubtless true in regard to the ornithology as well. They lie between latitudes 22° 10′ and 26° 52′ N. and longitudes 74° 30′ and 79° 8′ E.

The general declination of the country is to the north, falling from about 2,000 ft. along the Vindhyan Range to 500 ft. along its northern boundary. The country can be conveniently split up into three natural divisions with marked diversity of physical aspects,

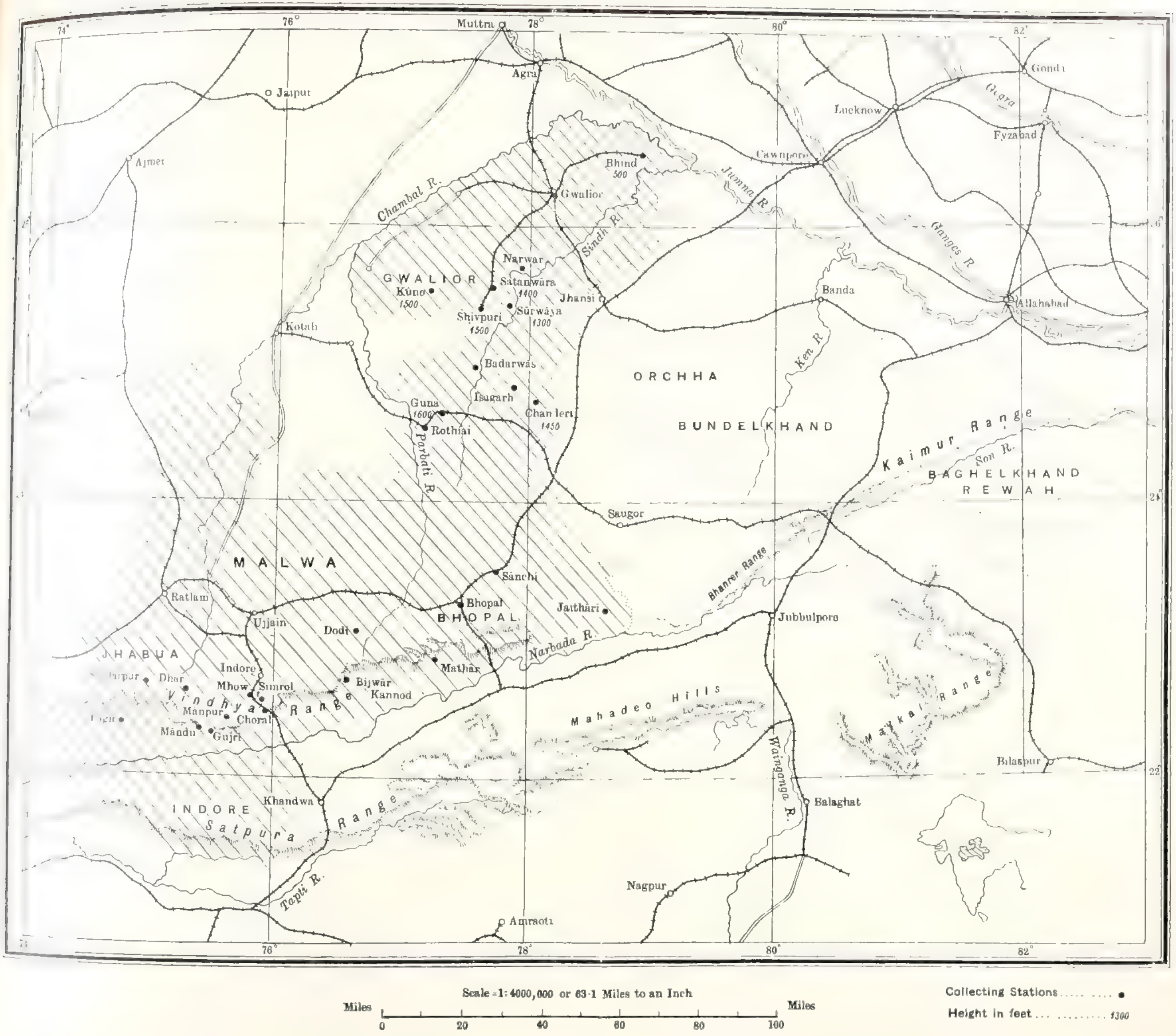
CENTRAL


74°
76°
78°
Muttra
Agra
Jaipur
Ajmer
Chambal R.
Gwalior
Sind
Narwar
GWALIOR
Kūno
1500
Satanwāra
1400
Jhansi
Sūrwāya
1300
Shivpuri
1500
Kotah
Badarwās
Isagarh
Guna
1600
Chanderi
1450
Rothiai
Udaipur
Parbati R.
25°
24°
23°
22°
MALWA
Sānchi
Ratlam
Bhopal
Jaithāri
BHOPAL
Ujjain
Dodi
Narbada R.
JHABUA
Indore
Mathār
Sardārpur
Dhār
Mhow
Simrol
Bijwār
Kannod
Vindhya Range
Mānpur
Choral
Bagh
Māndu
Gujri
Mah
Khandwa
INDORE
Satpura Range
Tapti R.
Amraoti

Scale = 1: 4000,000 or 63·1

Miles
0 20 40

CENTRAL INDIA



74°
76°
Muttra
78°
80°
82°
Agra
Gonda
Jaipur
Gogra
Lucknow
Fyzabad
Ajmer
Cawnpore
Bhind
500
Jumna R.
Chambal R.
Gwalior
Sindh R.
Ganges R.
Narwar
GWALIOR
Kuno
1500
Satanwara
1400
Jhansi
Banda
Allahabad
Shivpuri
1500
Surwaya
1300
Kotah
Ken R.
Badarwas
ORCHHA
Isagarh
Guna
1600
Chanderi
1450
Rothiai
BUNDELKHAND
Parbati R.
Kaimur Range
Son R.
BAGHELKHAND
REWAH
24°
Saugor
Bhanrer Range
MALWA
Sanchi
Ratlam
Bhopal
BHOPAL
Jaithari
Jubbulpore
Ujjain
Dodi
Narbada R.
JHABUA
Indore
Mathar
Dhar
Mhow
Simrol
Bijwar
Kannod
Vindhya Range
Mahadeo Hills
Maikal Range
Manpur
Choral
Mandu
Gujri
Wainganga R.
Bilaspur
22°
INDORE
Khandwa
Satpura Range
Balaghat
Tapti R.
Nagpur
Amraoti
76°
78°
80°
82°
Scale = 1: 4000,000 or 63·1 Miles to an Inch
Miles
Miles
0
20
40
60
80
100
Collecting Stations .... ●
Height in feet 1300

climate and scenery, namely (1) the Plateau, (2) the Low-lying portions or Plains, and (3) the Hilly Tracts.

The Plateau takes in most of Mālwa—an extensive tableland with a mean elevation of 1,600 ft. above sea level. In its widest sense, Mālwa includes the country between the Vindhyan barrier (which forms the northern bank of the Narbada Valley) and a point just south of Gwālior town. Its eastern limit is marked by a ridge running north to south starting near Bhilsa, while its western limit marches with the Rajputana border.

The Low-lying Tract or Plains, with a mean elevation of about 700 ft., embraces the country round Gwālior town, i.e. to the north and north-east of it, extending thence across into Būndelkhand of which it includes the greater part, till it meets the Kaimūr Hills in Baghelkhand.

The Hilly Tracts lie principally along the Vindhya and Satpūra Ranges and their numerous branches.

The country worked falls chiefly into two of these three natural divisions, namely Plateau and Hilly Tracts. Only the area to the north and north-east of Gwālior town up to the Chambal River comes in the Plains.

Temperature: The hill system, i.e. the parallel Vindhya and Satpūra Ranges (which strictly speaking are one range) of which isolated peaks rise to 3,000 ft., has a marked effect on the climate of Central India, both from the high tableland it forms on the west and from the direction it gives to prevailing winds at different seasons. The average maximum and minimum temperatures are as follows:

	Max.	Min.
Mālwa Plateau:		
January	77°	48° F.
May	103°	76°
Rains	83°	71°
Plains:		
January	74°	48°
May	107°	81°
Rains	87°	77°

Humidity: Variation of humidity in Central India during the year is marked. It is lowest in March, April and May; highest in January and August.

Rainfall: The whole of the area specifically dealt with in this paper is supplied by the Bombay monsoon current. Average fall: Plateau 30″; Plains 30-40″; Hilly Tracts 40-50″.

There are good grounds for believing that Central India has undergone marked desiccation during the last 300 years. Reports point to a diminution of at least 20″ in the annual rainfall during the last 70 or 80 years. In the 16th and early 17th centuries the Moghul Emperors Akbar and Jehangir hunted elephants about Narwar, Chandēri, Satwas, Bijagarh and Raisen the forests then containing some large herds. In their place there is nothing but stunted thorn jungle today, and it is obvious that the rainfall then must have been considerably heavier to support forests capable of harbouring elephants.

Flora: An immense area in Central India is covered by the fertile black cotton soil formed by the decomposition of the Deccan trap. The flora of the Deccan trap area differs markedly from the sandstone region of the hilly tracts. In the former mostly Dhāk (*Butea frondosa*) thrives, while on the latter the jungle is closer and the trees more abundant and of greater variety. The change to a sandstone soil is at once signalled by the presence of teak (*Tectona grandis*), tendū (*Diospyros tomentosa*), salāi (*Boswellia serrata*), sāj (*Terminalia tomentosa*) and other species.

The forests belong to the type designated by Champion[1] as 'Tropical Dry Forest'. They approximate mainly to the following of his subsidiary edaphic types:

E 3. *Hardwickia* forest.
E 4. *Boswellia* forest.
E 5. *Butea* forest.
E 6. *Anogeissus pendula* forest.
E 8. Cotton soil Babul forest.

ITINERARY.

Bhōpal State:

Sānchi, ca. 1,600 ft. (23° 29′ N × 77° 44′ E) 6-12 January.
Dōdi, ca. 1,700 ft. (23° 0′ N × 76 34′ E) 13-19 January.
Mathār, ca. 1,500 ft. (22° 52′ N × 77° 28′ E) 20-27 January.
Jaithāri, ca. 1,350 ft. (23° 13′ N × 78° 37′ E) 29 January-3 February.

Gwālior State:

Kūno, ca. 1,500 ft. (25° 32′ N × 77° 15′ E) 11 February-22 February.
March.
Narwar Fort, ca. 1,900 ft. (25° 38′ N × 77° 57′ E) 4-15 March.
March.
Sūrwāya, ca. 1,300 ft. (25° 25′ N × 77° 53′ E) 16-23 March.
Badarwās, ca. (24° 58′ N × 77° 32′ E) 24-31 March.
Gūna, ca. 1,600 ft. (24° 39′ N × 77° 21′ E) 31 March-5 April.
Chandēri, ca. 1,450 ft. (24° 43′ N × 78° 11′ E) 6-14 April.
Bhind, ca. 500 ft. (26° 33′ N × 78° 50′ E) 15-22 April.
Sardārpūr, ca. 1,650 ft. (22° 40′ N × 75° E) 14-18 September.
Bāgh ca. (22° 23′ N × 74° 45′ E) 18-20 September.

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[1] Champion, H. G.—'A Preliminary Survey of the Forest Types of India and Burma. Indian Forest Records (New Series) Silviculture', vol. i, No. 1 (Manager of Government Publications, Delhi, 1936).

As this is the latest and most comprehensive work on the classification of forest types, it is to be hoped that field ornithologists and those working on other groups of animals will generally make use of it wherever possible. Only by adopting a standard and well-defined terminology will it ever become possible for us to establish habitat types for our own subjects.

Indore State:

Bijwār, ca. 1,450 ft. (22° 42′ N × 76° 36′ E) 22-28 August.

Chōral, ca. 1,100 ft. (22° 26′ N × 75° 58′ E) 28 August-2 September.

Dhār State:

Gūjri, ca. 750 ft. (22° 19′ N × 75° 33′ E) 2-8 September.

Māndū, ca. 2,300 ft. (22° 20′ N × 75° 25′ E) 8-14 September.

SYSTEMATIC LIST.

Corvus macrorhynchus culminatus Sykes. The Southern Jungle Crow.

Specimen collected: 546 ♀ 25-3-38 Badarwās (Gwālior State).

Elsewhere noted: *Bhōpal*: Bhōpal town, Mathār, Jaithāri. *Gwālior*: Gwālior town, Satanwāra, Narwar, Sūrwāya, Chandēri, Sardārpūr. *Indore*: Indore town, Bijwār, Chōral, etc.

Common. Collecting sticks for nest 22-2-38 (Satanwāra). Nest nearing completion; both birds working, 11-4-38 (Chandēri).

Corvus splendens splendens Vieillot. The Indian House Crow.

Specimen collected: *Gwālior*: 547 ♂ 25-3-38 Badarwās.

Elsewhere noted: *Bhōpal*: Bhōpal town, Jaithāri, Sehore. *Gwālior*: Gwālior town, Kūno, Satanwāra, Sardārpūr. *Indore*: Indore town, Bijwār, Chōral, Mhow. *Dhār*: Dhār town, Māndū, Gūjri, etc.

Common. In and about towns and villages. Large flocks collecting every evening on shingly bank of Kūno River to drink before flying off to roost, 15-2-38 (Kūno). Feeding nearly full-fledged Koel (*Eudynamis scolopaceus*) in nest, 28-8-38 (Chōral).

Dendrocitta vagabunda vagabunda (Latham). The Indian Tree Pie.

Specimens collected: *Bhōpal*: 24 ♀ 8-1-38 Sānchi, 230 ♀ 31-1-38 Jaithāri. *Gwālior*: 262 ♀ 12-2-38 Kūno, 451 ♂ 9-3-38 Narwar Fort, 624 ♂ 7-4-38 Chandēri, 870 ♀ juv. 16-9-38 Tanda (near Sardārpūr). *Indore*: 737 o? juv. 29-8-38 Chōral.

[Nos. 737 and 870 are in juvenile plumage. There appears to be no difference between the juveniles of the four Indian races of this species, all that I have examined having the pale creamy fulvous underparts which are normally the distinction of *D. v. vernayi* in the adult.—H.W.]

Elsewhere noted: *Bhōpal*: Bhōpal town. *Gwālior*: Sūrwāya, Badarwās, Gūna, Bāgh. *Indore*: Indore town, Bijwār. *Dhār*: Dhār town, Gūjri, Māndū. Common.

Parus major mahrattarum Hartert. The Southern Grey Tit.

Specimens collected: *Bhōpal*: 155 ♂ Mathār 21-1-38. *Gwālior*: 309 ♀ 19-2-38 Kūno, 419 ♀ 5-3-38 Narwar Fort, 628 ♀ 8-4-38 Chandēri. *Indore*: 704 ♂ juv., 705 o? juv. 24-8-38 Bijwār, 728 ♂ 27-8-38, 736 o? juv. 29-8-38 Chōral, 741 ♂ 30-8-38, 814 ♂ 7-9-38 Mānpūr 1,500 ft. *Dhār*: 836 ♂ juv. 10-9-38 Māndū.

[Nos. 704, 705, 736, 814, 836 are all in juvenile plumage and all exactly alike, having the upper plumage tinged with green and the nuchal spot, cheeks and white of the underparts faintly washed with yellow as noted in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxv, p. 517). The post-juvenal moult has not yet commenced.—H.W.]

Elsewhere noted: *Bhōpal*: Sānchi, Jaithāri. *Gwālior*: Sūrwāya, Bāgh, Shivpūri.

Common. Family parties in August and September.

Machlolophus xanthogenys aplonotus (Blyth). The Yellow-cheeked Tit.

Specimens collected: *Bhōpal*: 63 ♂, 64 ♀ 11-1-38 Sānchi, 115 ♂ 17-1-38 Dōdi. *Gwālior*: 561 ♂, 562 ♀, 563 ♀, 564 ♀ 27-3-38, 383 ♂ 30-3-38 Badarwās, 600 ♀, 601 ♀, 602 ♂ 2-4-38, 621 ♀ 5-4-38 Gūna, 629 ♀ 8-4-38

Chandēri. *Indore*: 689 ♂ juv., 690 ♂, 691 ♂ juv., 692 o? juv. 23-8-38 Bijwār. *Dhār*: 831 ♂ juv. 9-9-38 Māndū.

[Chandēri provides the most northerly records for this race. This admirable series of 18 carefully sexed birds consists of 6 adult males, 8 adult females and 4 juvenile males. It will be remembered that in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxv, 521) I introduced the interesting problem of plumages of this group of Tits, and Mr. Sálim Ali has kept the matter carefully before him in his various surveys, contributing greatly to its elucidation. In the present case the six adult males are all black-headed birds with black ventral stripes. The eight adult females are black-headed with dull olive-green ventral stripes, and the 4 juvenile males are black-headed with black ventral stripes, as described in the Hyderabad Survey (*J.B.N.H.S.*, xxxvi, 371). It now remains to be proved that the juvenile female is black-headed with dull olive-green ventral stripes as in the adult female. I have seen no juvenile of this type in this race (and I have seen a juvenile marked female with the black ventral stripe, but the size—wing 70 mm.—suggested that the sexing was not reliable) but it occurs in the race *travancoreensis* and it is hardly credible that the juveniles of this sex should start with the black ventral stripe and assume an olive-green ventral stripe in adult plumage. It seems fairly safe therefore to draw up the following plumage scheme for the *Machlolophus xanthogenys* group as at present constituted:

Machlolophus xanthogenys xanthogenys: Adult male and female alike. Crown black; ventral stripe black. Juveniles alike and similar to adults.

Machlolphus xanthogenys travancoreensis: Adult male and female not alike. Male: crown black; ventral stripe black. Female: crown black; ventral stripe dull olive-green. Juveniles not alike but resembling their respective adults.

Machlolophus xanthogenys aplonotus: Adult male and female not alike. Male: crown black; ventral stripe black. Females dimorphic: phase (1) crown and eye-streak black, ventral stripe dull olive-green; phase (2) crown and eye-streak dull olive-green, ventral stripe dull olive-green. Juveniles not alike, but resembling their respective adults. As I have an unsexed juvenile from the Nilgiris with black crown and olive-green ventral stripe it would seem that both adult female phases are represented in the juvenile.

Unfortunately I have been unable to obtain any fresh material of *Machlolophus spilonotus* and *subviridis* to throw further light on their plumages and connection with the *xanthogenys* group.—H.W.]

Elsewhere not noted.

At the end of March males were observed courting females, singing with erected crest and drooping wings. A clear whistling *cheewit-pretty-cheewit*. Family parties of parents and 3 or 4 young usual in August/September. A male on 30 March had testes 2×1 mm. and was busy courting and singing. A male in full song also noted on 10-9-38.

Sitta castanea castanea Lesson. The Chestnut-bellied Nuthatch.

Specimens collected: *Indore*: 755 o? juv. 31-8-38 Chōral. *Dhār*: 837 ♂ juv. 10-9-38, 849 ♂ juv. 12-9-38 Māndū; 802 ♂ 6-9-38 Gūjri.

[Nos. 755, 837 and 849 are juveniles. As the juvenile plumage of this species does not appear to have been described, it may be recorded that both sexes closely resemble the respective adults of their sexes except that the chestnut-bay on the underparts of the male is not quite so rich and dark in colour.—H.W.]

Pairs or family parties of 3 or 4 in localised bird associations in forest. Almost invariably with *Dryobates hardwickii*.

Turdoides somervillei orientalis Jerdon. The Eastern Ghats Jungle Babbler.

Specimen collected: *Bhōpal*: 185 ♂ 25-1-38 Mathār.

[Although slightly intermediate in character this specimen is best kept with this race (vide Travancore Survey, *J.B.N.H.S.*, xxxviii, 72).—H.W.]

Elsewhere noted: *Bhōpal*: Sānchi, Dōdi. *Gwālior*: Kūno, Satanwāra, Narwar Fort, Sūrwāya. *Indore*: Bijwār. *Dhār*: Māndū, Badarwās, Gūna, Bhind.

Common. In forest. Usually in localised bird associations.

Argya caudata caudata (Dumont). The Common Babbler.

Specimens collected : *Bhōpal* : 16 ♂ 8-1-38 Sānchi, 102 ♂ 15-1-38 Dōdi, 218 ♀, 219 ♀ 30-1-38 Jaithāri. *Gwāliōr* : 448 ♂ 9-3-38, 483 ♂ 13-3-38 Narwar Fort, 666 ♀ juv., 667 ♀, 668 ♂, 669 ♂ 18-4-38, 680 ♂, 681 ♂ 19-4-38 Bhind, 876 ♀ 17-9-38 Sardārpūr. *Indore* : 763 ♂ 1-9-38 Chōral.

Elsewhere noted : *Gwalior* : Gwalior town environs, Kūno, Satanwāra, around base of Narwar Fort, Sūrwāya, Badarwās, Gūna and environs. *Indore* : Bijwār, *Dhār* : Māndū.

Common in dry open facies. Apparently breeds throughout the year. Gonads of specimens mature in March, April, August and September. Observed nest-building 13 and 20 March. Specimen No. 666 about 3 to 4 weeks old.

Argya malcolmi (Sykes). The Grey-headed Babbler.

Specimens collected : *Bhōpal* : 44 ♂, 45 ♀ 9-1-38 Sānchi.

Elsewhere noted : *Bhōpal* : Dōdi, Udaipur, Jaithāri. *Gwālior* : Gwālior town environs, Kūno, Satanwāra, Narwar (only in open thorn scrub and cultivation about base of Fort), Sūrwāya, Badarwās, Gūna and environs, Bhind, Sardārpūr. *Indore* : Indore town and environs, Bijwār, Chōral. *Dhār* : Gūjri, Māndū.

Common. Usually in facies not so dry as *A. caudata* and not so wooded as *T. somervillei,* but in patches side by side with either.

Dumetia hyperythra hyperythra (Franklin). The Rufous-bellied Babbler.

Specimens collected : *Bhōpal* : 51 ♀ 10-1-38 Sānchi, 146 ♂ 19-1-38 Dōdi, 172 o? 23-1-38 Mathār. *Gwālior* : 440 ♀, 441 o? 7-3-38, 443 ♂, 444 o? 8-3-38 Narwar Fort, 606 ♀ 2-4-38 Chhipon (Gūna Dist.). *Indore* : 713 o? juv. 24-8-38 Bijwār, 760 ♀, 761 ♂ 1-9-38 Chōral.

[No. 713 is a juvenile. It differs from the adult in lacking the chestnut tinge on the forehead and crown and the stiff shafts to the feathers of the forehead. The chestnut of the lower parts is considerably duller and paler. It has the soft brown rounded first primary and the soft tail feathers characteristic of the juveniles of the Timaliidae. These specimens clear up a point that has always puzzled me—as it did not agree with my mapping of the distribution of the two races of *hyperythra*. King (*J.A.S.B.*, 1868 p. 215) said that *Dumetia albogularis* occurs at Goona (Gūna) which the survey now shows to be incorrect. King's statement was doubtless another example of the confusion between the two races, from which even Jerdon was not immune.—H.W.]

Elsewhere noted : *Bhōpal* : Jaithāri. *Gwalior* : Rūthiāi, Chandēri, Bāgh. *Dhār* : Māndū.

Not uncommon in tall grass and thorn scrub country. Gonads mature 1-9-38. Juvenile 24 August.

Chrysomma sinensis sinensis (Gmelin). The Yellow-eyed Babbler.

Specimens collected : *Bhōpal* : 211 ♂ 26-1-38 Mathār, 226 ♂ 30-1-38 Jaithāri. *Gwalior* : 303 ♂ 19-3-38 Kūno, 462 ♂ 10-3-38 Narwar Fort.

Elsewhere noted : *Bhōpal* : Sānchi. *Gwālior* : Satanwāra, Sūrwāya, Badarwās. *Indore* : Bijwār. *Dhār* : Māndū.

Not uncommon in tall grass and scrub, usually in association with *Prinia sylvatica, Prinia inornata* and *Frnklinia gracilis.*

Ægithina tiphia humei Stuart Baker. The Central Indian Iora.

Specimens collected : *Bhōpal* : 4 ♀ 7-1-38, 37 ♀, 38 ♂? 9-1-38 Sānchi, 113 ♀ 17-1-38 Dōdi. *Gwālior* : 417 ♀ 5-3-38, 454 ♂ 9-3-38, 464 ♂? 12-3-38 Narwar Fort, 493 ♂ 17-3-38, 507 ♀ 18-3-38 Sūrwāya, 549 ♂ 25-3-38, 566 ♂ 27-3-38 Badarwās. *Indore* : 697 ♂ juv. 23-8-38, 706 o? juv. 24-8-38 Bijwār. *Dhār* : 823 o? juv. 824 ♀ 9-9-38 Māndū.

[The males obtained from 12-27 March are in body moult starting to assume the characteristic summer plumage. Nos. 697 ♂ and 823 o? are in the juvenile plumage. Both are alike and resemble the adult female in colour and pattern, but as the feathers are very soft, fluffy and decomposed the green of the upper plumage and the yellow of the lower plumage are definitely paler in appearance.—H.W.]

Elsewhere noted : *Gwālior* : Kūno, Sardārpūr, Bāgh.

Common. Testes of specimen 17 March enlarged to 5×3 mm.

Ægithina nigrolutea (Marshall). Marshall's Iora.

Specimens collected: *Gwalior*: 645 ♂, 646 ♀ 16-4-38 Bhind.

[These 2 specimens are not really typical *nigrolutea* but in the amount of white on the wings and tail they are intermediate between *Æ. t. humei* and *Æ. nigrolutea*. I have not noticed specimens of this intermediate type before and they of course make it still more evident—inspite of the difficulties of distribution—that *nigrolutea* must really be a race of *tiphia*, albeit approaching the status of a true species.—H.W.]

Elsewhere not noted.
Not uncommon about Bhind.

Chloropsis jerdoni (Blyth). Jerdon's Chloropsis.

Specimens collected: *Bhōpal*: 25 ♀ 8-1-38, 55 ♂, 56 ♀ 10-1-38 Sānchi. *Gwālior*: 626 ♂ 8-4-38, 633 ♂ 9-4-38 Chandēri. *Indore*: 693 ♂, 694 ♀ 23-8-38 Bijwār.

The April specimens had testes enlarged to 5×4 and 4×3 mm. respectively. The August pair are undergoing the complete post-nuptial moult.

Molpastes cafer pallidus Stuart Baker. The Central Indian Red-vented Bulbul.

Specimens collected: *Bhōpal*: 111 ♂ 17-1-38 Dōdi. *Gwālior*: 521 ♂, 522 ♀ 20-3-38 Sūrwāya.

Elsewhere noted: Sānchi, Jaithāri. *Gwālior*: Gwālior town and environs, Kūno, Satanwārā, Narwar Fort, Chandēri, Bhind, Sardārpūr. *Indore*: Indore town, Simrōl, Mhow, Chōral. *Dhār*: Dhār town, Gūjri, Māndū.

Common. Often congregations of over a hundred birds on Banyan and Peepal trees in fruit, and in fruiting Lantana patches.

Molpastes leucogenys leucotis (Gould). The White-eared Bulbul.

Specimens collected: *Gwālior*: 682 ♂, 683 ♀ 19-4-38 Bhind.

Elsewhere not noted.

The first and only meeting in Central India. A few amongst wooded outscoured ravines in Barāi *Dalbergia* Plantation near Chambal River. Breeding. Testes 7×5 mm.; ovary granular.

Oenanthe picata (Blyth). The Pied Chat.

Specimens collected: *Gwalior*: 367 ♀ 26-2-38, 371 ♀ 27-2-38, 388 ♀ 28-2-38 Satanwāra, 518 ♂ 19-3-38 Sūrwāya.

Elsewhere noted: Between Kūno and Pohri (Gwalior).

Sparingly. Pairs on stony, sparsely-scrubbed semi-desert facies. Excessively shy. Specimen of 19 March very fat.

Oenanthe deserti atrogularis (Blyth). Gould's Desert Chat.

Specimens collected: *Bhōpal*: 223 ♀ 30-1-38 Jaithāri. *Gwālior*: 336 ♂, 337 ♀ 24-2-38, 336 ♂ 26-2-38, 370 ♂ 27-2-38, 414 ♀ 3-3-38, Satanwāra.

Elsewhere noted: *Bhōpal*: Ashta, Bareli village. *Gwālior*: Sardārpūr.

Not uncommon in stony semi-desert country with stunted Bēr (*Zizyphus*) and Acacia bushes: *Lanius lahtora* facies. Earliest date: 15 September (Sardārpūr).

Oenanthe opistholeuca (Strickland). Strickland's Chat.

Specimens collected: *Gwālior*: 368 ♂ 26-2-38 Satanwāra, 517 ♂ 19-3-38 Surwāya.

Elsewhere not noted.

Sparingly—singly or pairs—in same facies as *Œ. picata*. Very shy. Specimen of 19 March very fat.

Cercomela fusca (Blyth). The Brown Rock-Chat.

Specimens collected: *Bhōpal*: 244 ♂, 245 ♀ 1-2-38 Jaithāri, *Gwālior*: 418 ♂ 5-3-38 Narwar Fort.

Elsewhere noted: *Bhōpal*: Sānchi, Sehore, Bhōpal town. *Gwālior*: Gwālior Fort, Gūna, Chandēri. *Dhār*: Māndū.

Common about old forts and ruined buildings. In full song in 2nd week of March. Nest building 13 March.

Saxicola caprata bicolor Sykes. The Northern India Stone-Chat.

Specimens collected: *Bhōpal*: 89 o? 15-1-38 Dōdi, 181 ♀ 24-1-38 Mathār, 224 ♂ 30-1-38, 243 ♂ 1-2-38 Jaithāri. *Gwālior*: 394 ♀ 28-2-38 Satanwāra, 478 ♂ 14-3-38 Narwar.

Elsewhere noted: *Bhōpal*: Sānchi. *Gwālior*: Kūno, Magrōni, Bhind.

Uncommon. Usually singly.

Saxicola torquata indica (Blyth). The Indian Bush-Chat.

Specimens collected: *Bhōpal*: 41 ♂ 9-1-38 Sānchi. *Gwālior*: 345 ♂ 25-2-38 Satanwāra, 487 ♂ 15-3-38 Narwar Fort.

Elsewhere noted: Jaithāri. *Bhōpal*: Bhōpal Lake environs. *Gwālior*: Kūno, Badarwās, Bhind, Sardārpūr.

Commoner than above. About cultivation and fallow land. Earliest date 17 September (Sardārpūr); latest 17 April (Bhind).

Cyanosylvia suecica suecica (Linnaeus). The Blue-throat.

Specimens collected: *Bhōpal*: 36 ♂ 9-1-38 Sānchi, 104 ♂ 15-1-38 Dōdi. *Gwālior*: 261 ♂ 12-2-38, 308 o? 19-2-38 Kūno, 410 ♂ 2-3-38 Satanwāra, 527 ♀ 21-3-38 Surwāya.

[The identification of winter Bluethroats is a matter of great difficulty and the group as a whole needs careful revision. These specimens are however certainly neither *abbotti* nor *pallidogularis* and I see no means of distinguishing them from the typical race.—H.W.]

Elsewhere noted: *Bhōpal*: Bhōpal Lake environs, *Gwālior*: Badarwās, Gūna, Rūthiāi, Rampūra Tank.

Common. In cotton and surgar-cane fields, and grass and reed patches by streams and tanks. Majority had departed by 4 April; after 7 April none seen.

Phoenicurus ochruros rufiventris (Vieillot). The Eastern Indian Redstart.

Specimens collected: *Bhōpal*: 33 ♂ 9-1-38 Sānchi. *Gwālior*: 421 ♀ 5-3-38, 459 ♀ 10-3-38 Narwar Fort, 523 ♀ 20-3-38 Sūrwāya, 558 ♂ 26-3-38 Badarwās, 881 o? 19-9-38 Bāgh.

[No. 558 is an unmistakable male of this race with the head and back black without any grey fringes. No. 881, unsexed but presumably a female, is very dark and can also be attributed to it without hesitation. The other 4 birds might in colour belong to either race, but in view of the large size may also be attributed to this race which about here seems to find its ordinary western limits in the Peninsula.—H.W.]

Elsewhere noted: *Bhōpal*: Bhōpal town. *Gwālior*: Kūno, Satanwāra, Chandēri, Bhind. *Dhār*: Māndū.

Latest date 16 April, by which most had departed: earliest 10 September. By 19 September appreciably commoner.

Saxicoloides fulicata cambaiensis (Latham). The Brown-backed Indian Robin.

Specimens collected: *Bhōpal*: 198 ♂ 25-1-38 Mathār. *Gwālior*: 557 ♂ 26-3-38 Badarwās. *Indore*: 751 ♂ 31-8-38 Chōral.

[These 3 birds vary *inter se* which is only to be expected. No. 557 is closer in colour to true *cambaiensis* than the other two birds which come from near the border line with *S. f. intermedia*, but I think all 3 specimens are best kept with *cambaiensis*.—H.W.]

Elsewhere noted: *Bhōpal*: Sānchi, Dōdi. *Gwālior*: Kūno, Satanwāra, Narwar Fort, Sūrwāya, Sardārpūr. *Indore*: Bijwār. *Dhār*: Māndū.

Common in Bhōpal and Gwalior, less so in Indore and Dhār. Breeding at end March. Gonads of 557 (26 March) mature. Nest on same date, and another bird with nesting material.

Copsychus saularis saularis (Linn.). The Indian Magpie Robin.

Specimens collected: *Bhōpal*: 177 ♂ 23-1-38, 204 ♀ 26-1-38 Mathār. *Gwālior*: 386 ♂ 28-2-38 Satanwāra.

Elsewhere noted: *Bhōpal*: Sānchi, Dōdi, Bhōpal town and environs. *Gwālior*: Kūno, Sūrwāya, Shivpūri, Badarwās, Gūna, Rūthiāi, Chandēri, Sardārpūr. *Indore*: Indore town and environs, Bijwār. *Dhār*: Māndū.

Common. First heard in song 28 February. Full song not general till 3rd week of March. Many tailless in September (moulting all rectrices simultaneously) and silent again.

Turdus simillimus mahrattensis Kinnear and Whistler.

Specimens collected: *Dhār*: 781 o? juv., 782 ♂ juv., 783 ♀ juv., 784 ♀ 4-9-38, 793 ♀ juv. 5-9-38, 797 ♂ juv., 798 ♀ juv., 6-9-38, 815 o? juv. 7-9-38 Gūjri, 821 ♀ juv., 822 ♀ juv. 9-9-38, 845 ♂ juv. 11-9-38 Māndū. *Indore*: 809 ♂ 7-9-38 Mānpūr.

[Nos. 781, 783, 797 and 815 are all in juvenile plumage and the post-juvenal moult has not yet commenced. They agree with two juvenile birds from Khandalla (June 1935 and July 1936) which I owe to the kindness of the authorities of St. Xavier's College, Bombay. From this series it is clear that the sexes are just distinguishable in juvenile plumage.

In the juvenile male the upper plumage, wings and tail are dark sooty blue grey, much as in the adult, the lesser and median coverts tipped with triangular fulvous spots, the ear coverts and sides of the neck streaked with fulvous; lower plumage dark ashy olive, the feathers broadly edged with blackish, the throat and the central breast and abdomen with the centres of the feathers largely white. The tail feathers are slightly narrower than in the adult.

The juvenile female has the upper plumage dull olive brown, the feathers faintly streaked with fulvous and edged with sooty; wings, tail and lower parts as in the adult.

Nos. 782, 793, 821, 822, 845 are immature birds in different states of progress with the post-juvenal moult. This includes the whole body plumage and the lesser and median coverts but evidently not the greater and primary coverts, the primaries, secondaries and tertiaries or the tail.

No. 784 is a very worn female just commencing to moult the wings. Nos. 798 and 809 are adults in heavy complete moult, the old feathers being greatly worn. It will be appreciated therefore that though this series of Blackbirds is most interesting from the point of view of plumage studies it is a poor one for racial identification. However, so far as it goes in that respect it would seem to belong to the form *Turdus simillimus mahrattensis* as one would expect. —H.W.]

Elsewhere not noted.

Common where occurring. Often localised and patchy. Completely silent except for throaty *chuck-chuck-chuck*. In wooded ravines at base of Vindhyas and feeding on jungle cart tracks.

Monticola solitaria pandoo (Sykes). The Indian Blue Rock-Thrush.

Specimens collected: *Bhōpal*: 74 ♀? 14-1-38 Dōdi, 194 ♂ 25-1-38 Mathār. *Gwalior*: 321 ♀ 20-2-38 Kūno, 875 ♀ 17-9-38 Sardārpūr.

[♂ No. 194 has a very long bill 31.5 mm., but comparison shows that it is not *longirostris* but *pandoo* with an abnormally long bill.—H.W.]

Elsewhere noted: *Bhōpal*: Sānchi, Bhōpal town and environs. *Gwālior*: Satanwāra, Narwar Fort, Sūrwāya, Rāmpūra Tank, Gwālior Fort. *Dhār*: Māndū.

Not uncommon. Singly about ancient forts and ruined buildings. Latest date 4 April earliest 11 September.

Monticola cinclorhyncha (Vigors). The Blue-headed Rock-Thrush.

Specimen collected: *Gwālior*: 617 ♂ 5-4-38 Bajranggarh Fort (near Gūna).

Elsewhere not noted.

A solitary example.

Siphia parva parva (Bechst.). The European Red-breasted Flycatcher.

Specimens collected: *Bhōpal*: 11 o? 7-1-38, 30 ♂ 9-1-38 Sānchi, 154 ♀ 21-1-38, 180 ♂ 24-1-38 Mathār. *Gwālior*: 266 ♂ 12-2-38, 274 ♂ 14-2-38 Kūno, 437 ♂ 7-3-38 Narwar Fort, 509 ♂ 18-3-38 Sūrwāya.

Elsewhere noted: *Bhōpal*: Bhōpal town, Dōdi.

Common. Usually singly, often in association with *Dicrurus coerulescens, Phylloscopus griseolus*, etc. on stony scrub covered hillocks. Also in groves of large trees. Latest date 18 March. Not met with again up till 20 September.

Muscicapula superciliaris superciliaris Jerdon. The White-browed Blue Flycatcher.

Specimens collected : *Bhōpal* : 202 ♂ 26-1-38 Mathār. *Gwālior* : 505 ♂ 18-3-38, 524 ♂ 20-3-38 Sūrwāya.

Elsewhere noted : Narwar Fort.

Not common. Usually singly.

Muscicapula tickelliæ tickelliæ (Blyth). Tickell's Blue Flycatcher.

Specimens collected : *Bhōpal* : 32 ♂ 9-1-38, 70 ♂ 11-1-38 Sānchi. *Gwālior* : 263 ♀ 12-2-38, 315 ♀? 20-2-38 Kūno, 619 ♂ 5-4-38 Bajranggarh (near Gūna), 637 ♀ 9-4-38, 643 ♀ 12-4-38 Chandēri. *Indore* : 703 o? juv. 24-8-38, 722 ♂ 26-8-38 Bijwār, 735 ♂ juv. 29-8-38 Chōral, 807 ♂, 808 ♀ 7-9-38 Mānpūr. *Dhār* : 794 ♂, 795 ♀ 5-9-38, 799 o? 6-9-38, 816 o? juv. 7-9-38 Gūjri, 826 o? juv. 9-9-38, 846 ♀ 11-9-38 Māndū.

[The adult female differs from the adult male in having the blue of the upper parts wings and tail duller and greyer and the chestnut of the throat and breast paler. The lores, which are black in the adult male, are dull bluish or white mottled by the dusky tips to the feathers. There is no spring moult in this species and the complete autumn moult (which starts simultaneously so far as the wing is concerned in both the inner primaries and the inner secondaries) takes place from the end of August to October.

The juvenile is described in the *New Fauna*, ii, 235 as a brownish, fulvous and white bird. This is quite incorrect. The wings and tail are blue in both sexes, brighter in the male, duller and greyer in the female—that is to say agreeing with the corresponding sexes of the adults. The body plumage has the characteristic squamation of the juvenile flycatchers, but the upper parts have a dark bluish tinge.

The five juveniles obtained by Mr. Sálim Ali unfortunately could not be reliably sexed. Nos. 703 and 735 appear on the evidence of the plumage to be males and Nos. 816, 826 and 846 to be females. The post-juvenal moult in all these specimens is confined to the body plumage except in 846 which is also moulting the tail. From these specimens it would appear that after the post-juvenal moult the birds of both sexes would be separable from their respective adults only by the fulvous tips to the greater wing coverts. In the Hyderabad Survey (*J.B.N.H.S.*, xxxvi, 387) I stated that the first winter male and female are indistinguishable from the adult ♀. This statement was based on Nos. 112 and 127 of the Hyderabad Survey, but it now seems clear that 127 must have been wrongly sexed.—H.W.]

Elsewhere noted : *Indore* : Indore town, Simrōl, Mhow. *Bhōpal* : Jaithāri.

Common. Invariably present in bamboo and scrub covered ravines.

Eumyias thalassina thalassina (Swainson). The Verditer Flycatcher.

Specimens collected : *Bhōpal* : 69 ♂ 11-1-38 Sānchi. *Gwālior* : 496 ♀ 17-3-38 Sūrwāya.

Elsewhere not noted.

Probably less uncommon than records indicate.

Alseonax latirostris (Raffles). The Brown Flycatcher.

Specimens collected : *Indore* : 698 ♀, 699 o? juv. 23-8-38 Bijwār, 701 ♂, 702 ♂ 24-8-38, 731 ♂ 29-8-38, 752 ♂, 753 ♀ 31-8-38 Chōral. *Dhār* : 806 ♂ 6-9-38 Gūjri.

[No. 699 is a juvenile with the post-juvenal body moult well advanced. The remainder are all adults which have nearly finished a complete post-nuptial moult. From this series one would be entitled to think that the birds had been collected on their breeding ground. It will be remembered that the breeding has already been recorded in much the same neighbourhood namely on the ghats near Mhow (Shelley, *J.B.N.H.S.*, ix, 223 and Betham, *J.B.N.H.S.*, xix, 989) and at Sehore (Whitehead, *J.B.N.H.S.*, xxi, 161). Curiously enough it has not yet been recorded as breeding anywhere between this area and North Kanara where Davidson found the eggs (*J.B.N.H.S.*, xi, 668.—H.W.]

Common. Not met with at all in Bhōpal or Gwālior between January and May!

Culicicapa ceylonensis pallidior Ticehurst. The Grey-headed Flycatcher.

Specimens collected: *Bhōpal*: 158 ♂ 21-1-38, 203 ♂ 26-1-38 Mathār.
Elsewhere noted: *Bhōpal*: Jaithāri.
Uncommon. Usually singly in localised bird associations in wooded glades and ravines.

Tchitrea paradisi paradisi (Linn.). The Indian Paradise Flycatcher.

Specimens collected: *Indore*: 727 ♀ 27-8-38 Bijwār. *Dhār*: 770 ♂ juv., 771 o? juv., 772 ♀, 773 ♂ juv. Gūjri.

[Nos. 727 and 772 are adult females which are finishing the complete post-nuptial moult. Their throats are grey, mottled slightly with black. The other three birds, namely 2 males and 1 unsexed, I take to be in the juvenile plumage and they exhibit no moult. They differ from the 2 adult females only in having shorter crests and in having the throat a purer grey with less of the black mottling, which indeed in 2 of the birds is practically absent.—H.W.]

Tchitrea paradisi leucogaster (Swains.). The Himalayan Paradise Flycatcher.

Specimens collected: *Gwalior*: 573 ♀ 28-3-38 Badarwās, 603 ♂ 2-4-38 Gūna, 610 ♂, 611 ♂ 4-4-38 Bajranggarh, 639 ♀ 11-4-38 Chandēri.

[Nos. 610 and 611 are adult males in the white phase with white streamers and are therefore identified by reference to the fact that the other 3 specimens obtained in Gwalior are most clearly of the pale race *leucogaster*. These ♂♀♀ are all in the same rufous plumage with the grey throat, but the female No. 639 is remarkable for having streamers 102 mm. longer than the rest of the tail, i.e. the total length of the tail and streamers is 199 mm. In the red phase of the adult male the tail with streamers runs from about 268-332 mm. These birds were presumably on passage.—H.W.]

Elsewhere noted (races undifferentiated): *Gwālior*: Narwar Fort, Rāmpūra Tank, Bhind, Bāgh. *Dhār*: Dhār town environs (Jhira Palace garden), Māndū.
Not observed in Bhōpal during January. First met with in Gwālior on 11 March, a single bird (♀?) obviously on passage. Common in Dhār during September; family parties in teak forest at foot of Vindhyas.

Hypothymis azurea styani (Hartl.). The Indian Black-naped Flycatcher.

Specimens collected: *Indore*: 711 ♂ 24-8-38 Bijwār, 810 ♀ 7-9-38 Mānpūr.

[Both are undegoing the complete adult post-nuptial moult. These specimens provide a slight extension of range in this area as the species has not here been recorded north-west of Sehore and Dhulia.—H.W.]

Elsewhere not noted.
Usually singly or pairs. In localised bird associations in forest, frequently in *Muscicapula tickelliae* facies.

Leucocera aureola aureola (Lesson). The White-browed Fantail Flycatcher.

Specimens collected: *Bhōpal*: 28 ♂ 9-1-38, 61 ♂ 10-1-38 Sānchi. *Gwalior*: 463 ♂ 12-3-38 Narwar. *Indore*: 740 ♂ juv. 30-8-38 Chōral.

[No. 463 from Narwar, Gwālior, is definitely of the typical race as defined by me in (*J.B.N.H.S.*, xxxvi, 91). The 2 Bhōpal birds are slightly intermediate, as one might expect, approaching the characteristics of *compressirostris* in the reduction of the white in the tail, but they may also be kept with the typical race. No. 740 is in post-juvenal body moult.—H.W.]

Elsewhere noted: *Bhōpal*: Dōdi, Jaithāri, Mathār. *Gwālior*: Kūno, Sūrwāya, Chandēri, Bhind, Sardārpūr, Bāgh. *Indore*: Bijwār.
Common. Usually in groves of large trees near villages and often in attendance on grazing cattle.

Lanius excubitor lahtora (Sykes). The Indian Grey Shrike.

Specimens collected: *Gwalior*: 334 ♀, 335 ♀ 24-2-38, 353 ♀ 25-2-38, 389 ♀ 28-2-38 Satanwāra.

Elsewhere noted: *Bhōpal*: Sānchi, Barēli village. *Gwālior*: Narwar (at base of Fort), Sūrwāya, Badarwās, Bhind.

Fairly common in semi-desert. Ovary of specimens on 24 and 25 February maturing. Nest with hard set c/2 (27×19 mm. each) on 30 March.

Lanius vittatus Valenciennes. The Bay-backed Shrike.

Specimens collected: *Bhōpal*: 114 ♀ 17-1-38 Dōdi. *Gwālior*: 393 ♀ 28-2-38 Satanwāra. *Indore*: 743 o? juv. 23-8-38 Chōral.

Elsewhere noted: *Bhōpal*: Bhōpal town environs, Sānchi. *Gwālior*: Gwālior Fort and environs, Kūno, Narwar Fort, Sūrwāya, Badarwās, Chandēri, Bhind. *Indore*: Bijwār. *Dhār*: Gūjri.

Common. The facies it favours is between the dry semi-desert of *L. e. lahtora* and the more wooded country of *L. schach*. In patches occuring with eithr. Courtship observed 18 March.

Lanius schach erythronotus (Vigors). The Rufous-backed Shrike.

Specimens collected: *Bhōpal*: 35 ♀ 9-1-38 Sānchi, 109 ♂ 17-1-38 Dōdi. *Gwalior*: 272 ♂ 14-2-38 Kūno. *Indore*: 714 ♀ 24-8-38 Bijwār.

Elsewhere noted: *Gwālior*: Satanwāra, Narwar Fort, Sūrwāya, Badarwās, Bhind. *Dhār*: Gūjri, Māndū.

Common. Carrying nest material 25 August.

Tephrodornis pondicerianus pallidus Ticehurst. The Sind Wood Shrike.

Specimens collected: *Bhōpal*: 168 ♂, 169 ♀ 22-1-38 Mathār. *Gwālior*: 290 ♀ 16-2-38 Kūno, 452 ♂, 453 ♀ 9-3-38 Narwar Fort, 672 ♀ juv., 673 ♂ juv. 18-4-38 Bhind. *Indore*: 756 ♀ 31-8-38 Chōral.

[In (*J.B.N.H.S.*, xxxviii, 309) I commented on the unsatisfactory nature of the races of this species and it is difficult to identify any series without reference to their locality of origin. However, for what it is worth, I consider that this series go better with *pallidus* than with the typical race. Nos. 672 and 673 are juveniles. They may be described as follows:—Upper plumage dull brown, the tips of the feathers spotted with pale fulvous, often edged with darker brown. Wing coverts conspicuously tipped with pale fulvous, the greater coverts and tertiaries mottled and submargined with dark brown. Wings, tail and tail-coverts as in the adult but the upper tail coverts and dark tail feathers are lightly tipped with fulvous. Supercilium fulvous. A band through the eye from the lores to the ear coverts dark brown streaked faintly with fulvous. Lower plumage white, faintly washed with fulvous, the sides of the chin and throat and the whole of the breast mottled and streaked with brown. The juvenile, in short, has a strong resemblance to a juvenile Flycatcher.—H.W.]

Elsewhere noted: *Bhōpal*: Sānchi, Jaithāri, Dōdi. *Gwālior*: Satanwāra, Shivpūri, Sūrwāya, Badarwās, Bāgh. *Indore*: Mhow, Bijwār. *Dhār*: Māndū.

Common.

Pericrocotus brevirostris brevirostris (Vigors). The Indian Shot-billed Minivet.

Specimens collected: *Gwalior*: 495 ♂ 17-3-38, 531 ♂, 532 ♀, 533 ♂ 21-3-38 Sūrwāya.

[Nos. 495 and 533 are yellow birds in plumage exactly agreeing with that of the female. No. 495 has some new feathers coming through on the throat which are yellow. If it is correctly sexed this must surely mean that the yellow male remains yellow, i.e. that it is dimorphism rather than a sign of immaturity.—H.W.]

Elsewhere noted: *Bhōpal*: Sānchi. *Gwālior*: Narwar Fort.

Not common.

Pericrocotus peregrinus peregrinus (Linn.). The Small Minivet.

Specimens collected: *Bhōpal*: 71 ♂ 11-1-38 Sānchi, 103 ♂ 15-1-38 Dōdi. *Gwālior*: 269 ♂ 12-2-38 Kūno, 458 ♂ 10-3-38, 485 ♂ 15-3-38 Narwar Fort, 882 ♂ juv. 19-9-38 Bāgh. *Indore*: 685 o? juv., 686 o? juv. 23-8-38, 716 o? juv. 25-8-38 Bijwār, 738 ♂ juv. 30-8-38 Chōral. *Dhār*: 774 ♀ juv. 3-9-38 Gūjri.

[I here follow the treatment of this group outlined in (*J.B.N.H.S.*, xxxvi, 342) which has borne the test of subsequent work satisfactorily. Nos. 685, 716, 738 and 882 are juveniles, the post-juvenal body-moult just beginning in No. 738. All are exactly alike. In plumage they agree with the adult female except that the upper parts are a browner grey, the feathers narrowly edged with pale fulvous, often edged interiorly with darker brown. All wing coverts have the tips edged with pale fulvous.—H.W.]

Elsewhere noted: *Bhōpal*: Mathār, Jaithāri. *Gwālior*: Satanwāra, Badarwās, Bhind, Barai, Sardārpūr.

Common. Family parties in August-September.

Pericrocotus erythropygius (Jerdon). The White-bellied Minivet.

Specimens collected: *Bhōpal*: 9 ♂ 7-1-38, 47 ♂ 9-1-38 Sānchi, 97 ♀, 98 ♀ 15-1-38, 144 ♀, 145 o? 19-1-38 Dōdi, 156 ♀, 157 ♀ 21-1-38 Mathār. *Gwālior*: 284 ♂, 285 ♂ 15-2-38 Kūno, 479 ♀ 14-3-38 Magrōni, 857 ♀, 858 o? juv. 15-9-38 Amjhēra.

[The juvenile No. 858 closely resembles the adult female but the greater part of the post-juvenal moult seems to be finished. A certain number of the feathers of the upper plumage have their tips finely edged with white; the primary coverts are tipped with white; the outermost white greater wing covert on each side is washed with yellow, a curious feature and possibly individual that appears in neither adult. Nos. 145 and 157 may be recognised as first winter birds by the retention of the white spotted primary coverts. —H.W.]

Elsewhere noted: *Gwālior*: Narwar, Satanwāra, Sūrwāya, Shivpūri.

Usually in dry thorn scrub and *Butea* jungle.

Lalage sykesii Strickl. The Black-headed Cuckoo-Shrike.

Specimens collected: *Indore*: 687 ♀, 688 ♂ juv. 23-8-38 Bijwār. *Dhār*: 769 o? juv. 3-9-38, 817 ♀ juv. 7-9-38 Gūjri, 825 ♂ 9-9-38 Māndū. *Gwālior*: 885 ♂ 19-9-38 Bāgh.

[No. 769 (♀ by measurement) is a juvenile. It is in plumage very similar to the adult female but the upper parts are barred, the grey feathers having a subterminal blackish bar and a pale fulvous terminal fringe. The median coverts are fulvous barred with blackish. The primaries and greater coverts, secondaries and tertiaries are edged with clear fulvous buff, itself edged interiorly with blackish on the tertiaries. The tail, of which the feathers are narrower and more pointed than in the adult, has the two central pairs of feathers edged with fulvous and the white of the remainder washed with fulvous. The black barring of the lower parts is, owing to the softness of the feathers, indistinct and largely broken up into mere mottling.

After the post-juvenal moult the first winter male and female are still alike and resemble the adult female. They may however be distinguished from her by the retention of the primary and greater wing coverts, primaries, secondaries and tertiaries with their clear fulvous buff edges (which however gradually fade into whitish) and by the retention of the narrow and pointed juvenile tail feathers.

It is not quite clear when the male moults into adult dress, but I believe it will be found to do so in the first spring so that the first summer plumage is the same as that of the adult.—H.W.]

Elsewhere noted: *Gwālior*: Sardārpūr.

Not met with in Bhōpal or in the Gwālior area surveyed between February and May.

Graucalus javensis macei (Lesson). The Large Indian Cuckoo-Shrike.

Specimens collected: *Bhōpal*: 14 ♀, 15 ♂ 8-1-38 Sānchi, 246 ♀ 1-2-38 Jaithāri. *Gwālior*: 856 ♀ 15-9-38 Amjhēra.

[No. 856 is a female in fresh first winter plumage. This resembles the adult female except that the whole of the underparts are a purer, less greyish, white with the barring of the chin, throat and breast more widely apart.

From the juvenile plumage the primaries and primary coverts, the bastard wing and secondaries, the tertiaries and the tail have been retained and with them of course their distinctive features.—H.W.]

Elsewhere noted: *Bhōpal*: Dewānganj, Dōdi. *Gwālior*: Satanwāra, Narwar Fort, Sūrwāya, Badarwās, Gūna. *Dhār*: Gūjri. *Indore*: Chōral.
Often near villages with groves of large trees. Eating Banyan figs. Parents with 2 full-fledged young on 8 September (Gūjri).

Dicrurus macrocercus peninsularis Ticehurst. The Black Drongo.

Specimens collected: *Bhōpal*: 135 ♀ 19-1-38 Dōdi, 229 ♂ 31-1-38 Jaithāri. *Indore*: 723 ♂, 724 ♂ 27-8-38 Bijwār. *Dhār*: 776 ♀ juv. 3-9-38 Gūjri.

[Ticehurst has dealt with this group very lucidly in *J.B.N.H.S.*, xxxvi, p. 927 and shown how this species gradually decreases in size from north to south throughout the Indian Peninsula. It is not of course possible to fix a hard and fast dividing line between *peninsularis* and *albirictus*, but as Nos. 135, 723 and 724 (♀♂♂ adults) have wings 142.5-145 mm. I think it is better to keep the Bhōpal, Dhār and South Gwālior area under *peninsularis* to which Ticehurst has already attributed birds from the South Central Provinces.—H.W.]

Elsewhere noted: *Bhōpal*: Bhōpal town and environs, Ashta. *Gwālior*: Satanwāra, Narwar Fort, Sūrwāya, Chandēri, Shivpūri.
Common. In August to September the majority minus outer tail feathers. In post-nuptial moult.

Dicrurus cœrulescens cœrulescens (Linn.). The White-bellied Drongo.

Specimens collected: *Bhōpal*: 3 ♂ 7-1-38, 34 ♀ 9-1-38 Sānchi. *Gwālior*: 435 ♂ 7-3-38 Narwar, 608 ♂ 2-4-38 Chhipon, 618 ♂ 5-4-38 Bajranggarh Fort. *Indore*: 700 o? juv. 23-8-38, 710 ♀ 24-8-38, 725 ♂ juv. 726 ♂ 27-8-38 Bijwār.

[I have not been very successful in diagnosing the age of all these birds, whether adult or first year, but 6 males have wings 125.5, 130, 130, 132, 133 and 136.5 mm., and 3 females have wings 122, 126.5 and 129 mm., so I presume the series may be attributed to the typical race. Until, however, a series is available from the type-locality Bengal, and until the situation in Ceylon is properly understood, it is difficult to work out the races of this species.—H.W.]

Elsewhere only noted at Chandēri (Gwālior).
Usually in localised bird associations in teak forest. Breeding in April. Testes of Nos. 608 and 618 17×8 and 12×6 mm. respectively.

Acrocephalus stentoreus brunnescens (Jerdon). The Indian Great Reed-Warbler.

Specimens not obtained.
Noted only at Rāmpūra Tank near Gūna (Gwalior 4 April). Unconfirmed.
In view of Briggs' remarks (*J.B.N.H.S.*, xxxv, 387-88) a special search made at Bircha Lake near Mhow (Indore) on 2 September. Owing to abnormally high level of water—rainfall about 20″ above average—reeds largely submerged. No Reed-Warblers present.

Acrocephalus dumetorum Blyth. Blyth's Reed-Warbler.

Specimens collected: *Dhār*: 832 ♀, 833 ♀ 10-9-38 Māndū.
Elsewhere not noted.
First heard 9 September.

Acrocephalus agricola Jerdon. The Paddy-field Warbler.

Specimens collected: *Gwālior*: 372 ♂, 373 o?, 374 ♂ 27-2-38 Satanwāra.
Elsewhere noted: *Bhōpal*: Bhōpal Lake.
Among reeds and bulrushes on tank margins.

Locustella nævia straminea Seebohm. The Eastern Grasshopper-Warbler.

Specimens collected: *Bhōpal*: 163 ♂ 22-1-38, 187 ♀, 188 ♀, 189 ♂ 25-1-38 Mathār.
Elsewhere noted: *Gwālior*: Satanwāra, Sardārpūr.

In patches of coarse matted grass by tanks and around cultivation in forest clearings. Earliest date: 17 September.

Orthotomus sutorius guzerata (Latham). The Tailor Bird.

Specimens collected: *Bhōpal*: 178 ♀ 24-1-38 Mathār. *Gwālior*: 273 ♂ 14-2-38 Kūno, 447 ♀ 8-3-38 Narwar Fort, 551 ♂, 25-3-38, 556 ♀ 26-3-38 Bādarwās, 651 ♂ 16-4-38 Bhind; 665 ♀ 17-4-38. *Indore*: 719 ♂ 25-8-38 Bijwār.

[It has always been stated and believed that the male Tailor Bird has the central tail feathers narrow and greatly elongated in summer and short and broad in winter, but this certainly does not always hold good so far as I have been able to study the plumages of the species. The actual sequence of plumages is not yet clear to me but the difficulty chiefly arises from the fact that the sexing of so many specimens (not this series) is unreliable. Carefully sexed birds are required from September to April.—H.W.]

Elsewhere noted: *Bhōpal*: Bhōpal town, Dōdi, Sehore. *Gwālior*: Gwālior Fort, Satanwāra. *Dhār*: Māndū.

Cisticola juncidis cursitans (Franklin). The Streaked Fantail-Warbler.

Specimens collected: *Bhōpal*: 141 ♂ 19-1-38 Dōdi, 191 ♀, 192 o?, 193 ♀ 25-1-38 Mathār, 216 ♂ 30-1-38 Jaithāri. *Gwalior*: 289 ♀ 16-2-38 Kūno, 383 ♂ 27-2-38 Satanwāra, 590 ♂, 591 o? 1-4-38 Rūthiāi, 634 ♂ 9-4-38 Chandēri.

[I have submitted this good series to Admiral Lynes who reports that all are perfectly typical *cursitans* obeying the plumage rules of this race, except for two points worth remarking. No. 141 has still got the 3 outer primaries of the left wing juvenile, probably due to a local pathological weakness. The testes of No. 216 are shown as 3×2 mm. in size, which combined with the fact that while the head and body plumage are winter in character the tail is new and summer plumage in character, suggest that some local factor such as irrigation with its effect on insect-life was inducing the birds to breed before their time.—H.W.]

Elsewhere noted: *Gwalior*: Sardārpūr. *Indore*: Bijāsan Ramna (near Indore town), Bircha Tank (near Mhow).
Common in tall grassland.

Franklinia gracilis (Franklin). Franklin's Wren-Warbler.

Specimens collected: *Bhōpal*: 80 ♀, 81 ♂ 14-1-38, 116 ♀ 17-1-38 Dōdi, 217 30-1-38 Jaithāri. *Gwālior*: 265 ♂ 12-2-38 Kūno, 291 ♂? 16-2-38, 400 ♂ 28-2-38 Satanwāra, 426 ♀ 6-3-38, 471 ♂ 13-3-38 Narwar Fort, 594 o? 1-4-38 Rūthiāi. *Indore*: 712 ♂ 24-8-38 Bijwār, 757 ♂ juv. 31-8-38 Chōral.

[No. 712 is in summer plumage. No. 757 is a juvenile. The remainder of this fine series are all in winter plumage and agree with the series of birds in winter plumage collected by the Jodhpur Survey which are much paler than bids in winter plumage collected by Mr. Waite and myself in the Punjab. Owing to the kind help of various correspondents I have been gradually assembling a number of specimens of this Wren-Warbler and it is quite clear now that my opinion expressed in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxvi, 564-566) that this species had no races is incorrect. It certainly has several races, but it is at present quite impossible to define them for two reasons. First of all the summer and winter plumages are quite different so that it is useless comparing any but birds in a similar state of plumage. The soft plumage of this warbler wears very quickly and fades and abraids into a nondescript tint. When one has eliminated such worn birds, juveniles and birds in spring and autumn moult, one is left with comparatively few specimens to work on and these are divided between two different plumages. The second reason is that the older writers, confused by summer and winter plumages and by the existence of these races, gave a number of names to this species and unfortunately the type-localities for these names are very badly represented in the series that I have been able to assemble. Until satisfactory topo-types are forthcoming, it is impossible to correlate the available names with the possible races. I therefore venture to append a list of the names and their type-localities in case any member of the Society has a chance of providing topo-types for the work. Birds in fresh winter plumage are required.

Franklinia gracilis Franklin. Type locality: Ganges, between Calcutta and Benares and in the Vindhyan Hills between the latter place and Gurra Mandela on the Narbada.

Prinia hodgsoni Blyth. Type locality: Nepal.

Prinia adamsi Jerdon. Type locality: Poona.

Prinia albogularis Walden. Type locality: Coorg.

Prinia humilis Hume. Type locality: N-W. Provinces and the Punjab.

Prinia rufula Godwin-Austen. Type locality: Naga Hills and Manipur. —H.W.]

Elsewhere noted: *Bhōpal*: Sānchi. *Gwālior*: Badarwās, Chandēri, Bāgh. *Dhār*: Gūjri, Māndū.

Common. Flocks in grass and thorn jungle, and light forest. Breeding in August. Testes of 712 5×3 mm. Nest with 2 young 24 August (Chōral). Males singing and displaying.

Franklina buchanani (Blyth). The Rufous-fronted Wren-Warbler.

Specimens collected: *Bhōpal*: 82 ♂ 14-1-38 Dōdi. *Gwālior*: 275 ♂ 14-2-38, 286 ♀ 15-2-38, 302 ♂ 19-2-38 Kūno, 363 ♂? 364 ♀ 26-2-38 Satanwāra. *Indore*: 759 ♂ juv. 1-9-38 Chōral, 786 ♀ 5-9-38 Mandlēshwar.

Elsewhere noted: *Gwālior*: Gwālior Fort environs, Narwar Fort, Badarwās, Bhind.

Common in dry, open thorn and grass scrub jungle, and stony semi-desert. Habits on ground very like *Scotocerca*. Flocks, frequently in association with *Franklinia gracilis* and *Chrysomma*. Courting and in full song at end February. Nest with c/3 16 April (Bhind).

The position of this nest was given away by the curious fact of one of the owners carrying a green caterpillar to it although it contained no young as yet!

Hippolais caligata rama (Sykes). Sykes's Tree-Warbler.

Specimens collected: *Gwālior*: 489 o? 17-3-38 Surwāya, 519 ♂ 19-3-38. *Indore*: 696 o? 23-8-38 Bijwār.

Hippolais caligata caligata (Licht.).

Specimens collected: *Gwālior*: 571 ♀ 28-3-38 Badarwās, 596 ♂ 1-4-38 Rūthiāi 647 ♀, 648 ♀, 649 ♀, 650 ♀ 16-4-38, 674 ♀ 18-4-38 Bhind.

[No. 696 is a bird in juvenile plumage, just beginning to moult the tail. I have noticed before that young birds of this species migrate in juvenile plumage. They differ from the adults in being more of a pale sandy grey colour above and the lower parts are whiter.

The name *caligata* was at one time discarded because it was said that the type of *caligata* was not a *Hippolais*. This, however, was proved to be a mistake (vide Stresemann, *Orn. Monatsb.* 1928, p. 51) and the emendation has now been accepted by European workers and we must follow suit using it as the specific name since it is the oldest of the three names *caligata*, *rama* and *scita*.—H.W.]

Fairly common. Usually singly, often gregariously, hunting insects on freshly sprouting foliage of Chilor (*Holoptelea integrifolia*) and Peepal (*Ficus religiosa*). Also on *Butea frondosa* blossoms.

Earliest date: 23 August, latest 18 April.

It will be noted that earliest specimen (23 August) is a young bird.

Sylvia hortensis jerdoni (Blyth). The Eastern Orphean Warbler.

Specimen collected: *Gwālior*: 616 ♀ 5-4-38 Bajranggarh Fort (near Gūna). The only example met with by the Survey.

Sylvia curruca blythi Ticeh. and Whistl. The Indian Lesser Whitethroat.

Specimens collected: *Bhōpal*: 62 ♀ 11-1-38 Sānchi, 88 ♂ 14-1-38 Dōdi. *Gwālior*: 344 ♀ 25-2-38, Satanwāra, 480 ♂ 14-3-38 Narwar Fort, 500 ♀ 18-3-38 Surwāya, 598 ♂ 1-4-38 Rūthiāi, 659 ♀ 17-4-38 Bhind; 874 ♂ 17-9-38 Sardārpūr. *Indore*: 785 o? 5-9-38 Mandlēshwar.

Elsewhere noted: *Bhōpal*: Jaithāri. *Gwālior*: Kūno, Badarwās, Gūna.

Common. Earliest date 5 September, latest 17 April. Specimens of 18 March and 17 April very fat.

Phylloscopus collybita tristis Blyth. The Brown Willow-Warbler.

Specimens collected: *Bhōpal*: 110 ♀ 17-1-38 Dōdi. *Gwālior*: 379 ♂ 27-2-38 Satanwāra, 494 ♂ 17-3-38 Surwāya.

Usually in cotton fields or among reeds and bulrushes by water. Also on *Butea* flowers. Specimen of 17 March very fat.

Phylloscopus griseolus Blyth. The Olivaceous Tree-Warbler.

Specimens collected: *Bhōpal*: 6 ♂ 7-1-38 Sānchi, 106 ♀ 17-1-38 Dōdi. *Gwālior*: 470 ♀ 13-2-38 Narwar Fort, 567 ♀, 568 ♀ 27-3-38 Badarwās.

Elsewhere noted: *Bhōpal*: Mathār.

Fairly common. Singly—sometimes 2 or 3 together—on stony scrub covered hillocks, walls of ancient forts and steep sides of rocky ravines. Unfailingly about the stupas at Sānchi in January. Latest date 27 March. Not observed in Indore and Dhār, August/September.

Phylloscopus subviridis (Brooks). Brook's Willow-Warbler.

Specimens collected: *Gwālior*: 515 ♀ 19-3-38 Surwāya.

Elsewhere not recognised.

Phylloscopus inornatus humii (Brooks). Humeii's Willow-Warbler.

Specimens collected: *Bhōpal*: 153 ♀ 21-1-38 Mathār. *Gwālior*: 420 ♂ 5-3-38 Narwar Fort.

Elsewhere not recognised.

Phylloscopus nitidus viridanus Blyth. The Greenish Willow-Warbler.

Specimens collected: *Gwālior*: 268 ♂ 12-2-38 Kūno, 860 ♂ 15-9-38 Amjhēra. *Dhār*: 768 ♂ 3-9-38 Gūjri.

Earliest date 3 September. Fairly common by 15 September.

Phylloscopus occipitalis occipitalis (Blyth). The Large Crowned Willow-Warbler.

Specimens collected: *Indore*: 707 o? 24-8-38, 718 o? 25-8-38 Bijwār; 739 ♂ 30-8-38 Chōral 754 o? 31-8-38. *Dhār*: 813 o? 7-9-38 Gūjri.

I have no record from Bhōpal or Gwalior. Earliest date 24 August, but had probably arrived a few days earlier.

Prinia socialis stewarti Blyth. Stewart's Ashy Wren-Warbler.

Specimens collected: *Gwālior*: 264 ♂ 12-2-38, 307 ♀ 19-2-38 Kūno, 520 ♂ 19-3-38 Surwāya, 587 ♂, 588 ♂, 589 ♂ 1-4-38 Rūthiāi, 663 ♂, 664 ♂ 17-4-38 Bhind.

Elsewhere noted: *Bhōpal*: Dōdi. *Indore*: Mānpūr. *Dhār*: Māndū.

[All the above are in the winter plumage as described in *J.B.N.H.S.*, xxxvi, 573, but Nos. 663 and 664 are starting to moult into summer plumage. —H.W.]

In grass by stream banks, etc.—wetter facies than *P. inornata*. Breeding August to September. One carrying food 7 September.

Prinia sylvatica gangetica (Blyth). The Northern Jungle Wren-Warbler.

Specimens collected: *Bhōpal*: 186 ♀ 25-1-38, 205 ♂, 206 ♂, 207 ♂, 208 ♀, 209 ♀, 210 ♀ o? 26-1-38 Mathār. *Gwālior*: 427 ♂, 428 ♀, 429 ♂ 6-3-38, 466 ♂ 12-3-38, 472 ♀, 473 ♂ 13-3-38 Narwar Fort, 506 ♂ 18-3-38 Surwāya, 581 ♂, 582 ♂ 30-3-38 Badarwās, 869 ♀ 16-9-38 Tānda (near Sardārpūr), 879 o? 19-9-38 Bāgh.

[No. 869 is a female in summer plumage. No. 879 is a juvenile, male by measurement. The remainder of this fine series are all in winter plumage but No. 582 has the spring moult just beginning. It is worth remarking that Nos. 207, 427 and 473 have each got a single white feather of the summer type in the tail. This feather is unworn. 10 males in winter plumage yield the following measurements:

Bill from skull 15.5-17, all but the 2 extreme birds measuring 16-16.5 mm.; wing (58) 61-67.5; tail (70) 84.5-95.5; tarsus 22.5-24.5 mm.

The juvenile No. 879 (which unfortunately lacks the tail) is very similar in colour to the female in summer plumage, but there is a faint yellowish wash in the plumages most marked on the sides of the head and the underparts.—H.W.]

Elsewhere noted: *Indore*: Chōral.

Common in open tall grass and thorn scrub country, often in association with *Dumetia*, *Chrysomma*, and *Franklinia gracilis*. In song and breeding August/September. Largest ovarian follicle of specimen 16 September 3 mm. in diameter.

Prinia inornata terricolor (Hume). The North Indian Wren-Warbler.

Specimens collected: *Bhōpal*: 140 ♀ 19-1-38 Dōdi, 213 ♂?, 214 ♂, 215 ♀ 30-1-38, 248 ♂ 2-2-38 Jaithāri. *Gwālior*: 258 ♂, 259 ♂ 12-2-38, 295 ♂ 17-2-38 Kūno, 343 ♀ 24-2-38 Satanwāra, 555 ♀ 26-3-38, 580 ♀ 29-3-38 Badarwās, 675 ♂ 18-4-38 Bhind. *Indore*: 715 ♂ 25-8-38 Bijwār.

[No. 715 is in summer plumage. The remainder are all in winter plumage, but Nos. 580 and 675 are just beginning the spring moult.—H.W.]

Elsewhere noted: *Indore*: Chōral, Mhow. *Dhār*: Māndū.

Common among Bēr and other thorn thickets mixed with tall grass, and also in patches of tall grassland. Breeding August September. Testes of specimen 25 August 5×3 mm. Nests at Chōral 1 September, and Bircha Lake (near Mhow) 2 September.

Cephalopyrus flammiceps flammiceps (Burton). The Fire-capped Tit-Warbler.

Specimen collected: *Gwālior*: 511 ♂ 18-3-38 Surwāya.

Elsewhere not noted.

The specimen was a solitary bird eating exudation from petioles of Banyan leaves. Movements and habits very like *Dicaeum*. Very fat.

Oriolus oriolus kundoo Sykes. The Indian Oriole.

Specimens collected: *Bhōpal*: 12 ♂ 8-1-38 Sānchi. *Gwālior*: 613 ♂ 4-4-38 Gūna, 627 ♂ 8-4-38 Chandēri. *Indore*: 729 ♂ 27-8-38 Bijwār. *Dhār*: 804 ♀ 6-9-38 Gūjri.

Elsewhere noted: *Gwālior*: Bajranggarh, Bhind, Sardārpūr, Bāgh. *Dhār*: Māndū.

None observed between 8 January and 3 April!

Oriolus xanthornus maderaspatanus (Franklin). The Indian Black-headed Oriole.

Specimen collected: *Gwālior*: 620 ♀ 5-4-38 Gūna.

Not noted elsewhere.

Rare.

Pastor roseus (Linn.). The Rose-coloured Starling.

Specimens collected: *Gwālior*: 559 ♀, 560 ♀ 26-3-38 Badarwās.

Elsewhere noted: *Bhōpal*: Bhōpal Lake environs. *Gwālior*: Satanwāra, Shivpūri, Surwāya, Bhind.

By 25 September they had not arrived in Central India though a flock was observed in New Delhi on 16 August. Latest date recorded by survey 16 April when they were still fairly abundant at Bhind, feeding on *Butea* nectar. Mostly in breeding plumage.

Sturnus vulgaris poltaratzskii Finsch. Finsch's Starling.

Specimens collected: *Gwālior*: 342 ♀ 24-2-38, 350 ♀ 25-2-38, 351 ♀?, 411 ♀, 412 ♀ 3-3-38 Satanwāra.

Elsewhere not noted.

A small flock attending grazing cattle on wet grassy tank margin. 3 of the specimens very fat and with conspicuously granular ovaries.

Sturnia malabarica ssp.? The Grey-headed Myna.

Specimen collected: *Dhār*: 820 ♀ 9-9-38 Māndū (a young bird in post-juvenal moult).

Elsewhere not noted.

This was the first and only meeting in Central India. Flocks of up to 20 birds including individuals with conspicuously white heads! (*blythii*?)

Temenuchus pagodarum (Gmelin). The Black-headed Myna.

Specimen collected: *Bhōpal*: 101 ♂ 15-1-38 Dōdi.

Elsewhere noted: *Bhōpal*: Sānchi. *Gwālior*: Satanwāra, Surwāya, Badarwās, Chandēri, Bhind. *Indore*: Bijwār. *Dhār*: Gūjri, Māndū.

Fairly common. Accompanied by juveniles in August/September.

Acridotheres tristis tristis (Linn.). The Common Myna.

Specimen collected: *Bhōpal*: 182 ♀ 24-1-38 Mathār.

Elsewhere noted: *Bhōpal*: Bhōpal town and environs, Sānchi, Sehore, Dōdi. *Gwālior*: Gwālior town and environs, Kūno, Satanwāra, Narwar, Surwāya, Gūna, Bhind, Sardārpūr. *Indore*: Indore town and environs, Mhow, Chōral.

Common. Collecting nest material 20 April. Nest with 4 chicks 5-7 days old 28 August (Chōral).

Acridotheres ginginianus (Latham). The Bank Myna.

Specimen collected: *Gwālior*: 365 ♂ 26-2-38 Satanwāra.

Elsewhere noted: *Bhōpal*: Sānchi, Dōdi. *Gwālior*: Kūno, Surwāya, Badarwās, Bhind.

Not uncommon but patchy. Usually in attendance on grazing cattle, also about refuse dumps on village outskirts.

Sturnopastor contra dehrae Stuart Baker. The Punjab Pied Myna.

Specimens collected: *Gwālior*: 476 ♀ 14-3-38 Magrōni (near Narwar), 543 ♂ 25-3-38 Badarwās.

Elsewhere noted: *Bhōpal*: Sānchi, between Bhōpal and Jaithāri. *Gwālior*: Bhind.

[If the two races—*contra* and *dehrae*—are to be recognised, and the difference between them is certainly not very marked or constant, these birds are of course *dehrae*.—H.W.]

Not common. Frequently about refuse dumps near villages.

Ploceus philippinus philippinus (Linn.) The Baya.

Specimens collected: *Bhōpal*: 137 ♀, 138 ♀, 139 ♀ 19-1-38 Dōdi. *Gwālior*: 432 ♀, 433 ♂, 434 ♀ 7-3-38 Narwar.

Elsewhere noted: *Gwālior*: Kūno, Satanwāra, Surwāya, Badarwās, Bhind. Scattered nest colonies in Indore and Dhār States—general.

Common. Shifting markedly with the seasons. Many old nest colonies observed in the dry season where no Bayas were to be seen then.

Uroloncha malabarica (Linn.). The White-throated Munia.

Specimens collected: *Bhōpal*: 252 ♀, 253 ♂ 2-2-38 Jaithāri. *Gwālior*: 279 ♀, 280 ♂ 15-2-38 Kūno, 380 ♂, 381 ♂, 382 ♀ 27-2-38 Satanwāra, 438 ♀ 7-3-38 Narwar.

Elsewhere noted: *Bhōpal*: Sānchi, Dōdi. *Gwālior*: Magrōni, Harsi Dam, Bhind Barai. *Indore*: Bijwār, Chōral. *Dhār*: Gūjri.

Common all over Central India. Breeding January, February, March, August, September. Probably throughout the year.

Uroloncha punctulata lineoventer (Hodgson). The Spotted Munia.

Specimens collected: *Indore*: 708 ♀, 709 ♂ Bijwār 24-8-38.

Elsewhere noted: *Dhār*: Māndū.

Uncommon. In fresh breeding plumage in August/September. Largest ovum of 708, 5 mm. in diameter; testes of 709, 7×5 mm. Nest with c/7 on 10 September (Māndū).

Stictospiza formosa (Lath.). The Green Munia.

Specimen collected : *Bhōpal* : 122 ♂ 18-1-38 Dōdi.
Elsewhere noted : *Gwālior* : Badarwās (unconfirmed).
Uncommon and sporadic.

Amandava amandava amandava (Linn.). The Indian Red Munia.

Specimens collected : *Bhōpal* : 251 ♂ 2-2-38 Jaithāri. *Gwālior* : 299 o?, 300 o? 17-2-38 Kūno.
Frequenting tall grass patches—*Cisticola* facies.

Carpodacus erythrinus erythrinus (Pallas). The Common Rose-Finch.

Specimens collected : *Bhōpal* : 50 ♂ 10-1-38 Sānchi, 148 ♀ 19-1-38 Dōdi, 225 ♂ 30-1-38, 227 ♂, 228 ♂ 31-1-38 Jaithāri. *Gwālior* : 501 ♂ 18-3-38 Surwāya, 862 ♂ 15-9-38 Sardārpūr.

[With the exception of No. 862 which is in worn breeding dress and somewhat brighter than many specimens of the typical race of the common Rose-Finch, I have no hesitation in attributing this series to the typical form whose winter quarters have always been a subject of speculation and mystery. This race passes through the N-W.F. Province and the Punjab on both the spring and autumn passages. See *Ibis*.—H.W.]

Elsewhere noted : *Gwālior* : Badarwās, Chandēri, Amjhēra.
Earliest date 15 September ; latest 7 April. Flocks feeding largely on linseed where available. Stomachs of specimens shot about this cultivation contained linseed exclusively. Also very partial to *Butea* nectar.

Gymnorhis xanthocollis xanthocollis (Burton). The Yellow-throated Sparrow.

Specimens collected : *Bhōpal* : 5 ♀ 7-1-38, 57 ♂, 58 ♂ 10-1-38 Sānchi, 170 ♂ 22-1-38 Mathār. *Gwālior* : 883 ♂ 19-9-38 Bāgh.

[Nos. 57, 170 and 883 are typical dark *xanthocollis*. Nos. 5 and 58 on the other hand are much paler and would pass very satisfactorily as the Sind-Perso-Baluchistan-Punjab race *transfuga*. This species is, however, very unstable in colour and I have often wondered whether it is worth recognising the two races. It is impossible to say, therefore, whether Nos. 5 and 58 are merely non-typical examples of *xanthocollis* or winter visitors of *transfuga* which is only a summer visitor to the extreme north-west of India. Only careful local observations by a resident naturalist can really settle the point. —H.W.]

Elsewhere noted : *Bhōpal* : Jaithāri. *Gwālior* : Kūno, Satanwāra, Narwar Fort, Surwāya, Badarwās, Chandēri, Shivpūri.
Common in the dry season. Noted as absent in August and up to 19 September when the first and only example was again met. By 23 September it was becoming more prominent. Decidedly local migrant.

Passer domesticus indicus Jardine & Selby. The House-Sparrow.

Specimens collected : *Gwālior* : 395 ♀, 396 ♂, 397 ♂ 28-2-38 Satanwāra, 886 ♂ 19-9-38 Bāgh. *Dhār* : 777 ♂ juv. 3-9-38 Gūjri.
Very common everywhere as a commensal of man.

Emberiza stewarti Blyth. The White-capped Bunting.

Specimens collected : *Gwālior* : 256 ♀, 257 ♂ 12-2-38, 276 ♂ 14-2-38, 282 ♀, 283 ♂ 15-2-38 Kūno, 415 ♂, 416 ♀ 5-3-38 Narwar Fort, 439 ♀ 7-3-38.
Elsewhere noted : *Gwālior* : Surwāya, Badarwās, Gūna, Rūthiāi.
Common in winter.

Emberiza melanocephala Scopoli. The Black-headed Bunting.

Specimens collected : *Bhōpal* : 118 ♂? 17-1-38 Dōdi. *Gwālior* : 855 ♂ 15-9-38 Amjhēra.
Elsewhere noted : *Gwālior* : Satanwāra.
Not common. Earliest date 15 September.

Emberiza bruniceps Brandt. The Red-headed Bunting.

Specimens collected: *Bhōpal*: 126 ♀, 127 ♀ 18-1-38 Dōdi. *Gwālior*: 502 ♂ 18-3-38, 536 ♂, 537 ♂, 538 ♀ 22-3-38 Surwāya.

[No. 502 has an abnormal beak with the upper mandible 27 mm. long and the lower mandible 18.5 mm. The bill of a normal male measures 14-16 mm. The upper mandible is slightly twisted towards the right and the lower mandible slightly towards the left. This fact, together with the unhealthy scabrous condition of the feet with overgrown claws suggests that the bird may have been in captivity though the plumage is normal and in good condition.—H. W.]

Elsewhere noted: *Gwālior*: Badarwās.
Not abundant, but rather more common than the Black-headed Bunting.

Melophus lathami subcristata (Sykes). The Crested Bunting.

Specimens collected: *Bhōpal*: 17 ♂, 18 ♂, 19 ♂, 20 ♀ 8-1-38 Sānchi, 220 ♂ 30-1-38 Jaithāri. *Gwālior*: 310 ♂ 19-2-38 Kūno, 385 ♂ 28-2-38 Satanwāra, 460 ♂ 461 ♂ 10-3-38 Narwar Fort, 597 ♀ 1-4-38 Rūthiāl (near Gūna).

[The plumages of this bird are rather puzzling and I have not yet been able to work them out satisfactorily. It may be that the sequences are very irregular but I am inclined to think that the explanation will prove to be that the female is dimorphic and the young male also dimorphic, individuals resembling both phases of the adult female.—H. W.]

Elsewhere noted: *Gwālior*: Surwāya, Gūna, Bajranggarh, Chandēri. *Indore*: Bijwār, Chōral, Simrōl Ghāt. *Dhār*: Gūjri.
Common. Colouration very obliterative on burnt patches in grass and scrub jungle to which the species is partial. Preparing to breed in March to April. Males in full song, and courtship general.

Riparia paludicola [chenensis (Grey)]. The Indian Sand-Martin.

No specimens.
Noted (unconfirmed) only at Kwāri River near Bhind (Gwalior). Several.

Riparia rupestris (Scop.). The Crag-Martin.

No specimens.
Noted: *Gwālior*: Narwar Fort. 3 or 4 flying steadily due north at sunset 19-3-38.

Riparia concolor (Sykes). The Dusky Crag-Martin.

Specimens collected: *Gwālior*: 322 ♂, 323 ♀, 324 ♂ 20-2-38 Kūno, 430 ♂ 6-3-38 Narwar Fort, 631 ♂ 9-4-38 Chandēri.
Elsewhere noted: *Bhōpal*: Sānchi, Dewānganj, Bhōpal town. *Gwālior*: Sardārpūr. *Indore*: Bijwār, Indore town environs, Mhow. *Dhār*: Māndū.
Common. Invariably about rock scarps and ruined forts and buildings. Breeding August/September; nests with eggs, and flying juveniles. Also in February. Gonads of specimens mature on 20th February.

Hirundo rustica subsp.? The Common Swallow.

Specimen collected: *Gwālior*: 405 o? 2-3-38 Satanwāra.

[An immature bird and unsexed, with a wing of 112 mm., which I cannot identify racially. Wing and tail are in moult, but post-juvenal body moult has scarcely begun.—H.W.]

Elsewhere noted: *Bhōpal*: Bhōpal Lake.
Small numbers in association with *Hirundo filifera, H. daurica* and *H. fluvicola* near water.

Hirundo smithii filifera Stephens. The Indian Wire-tailed Swallow.

Specimens collected: *Bhōpal*: 124 ♂, 125 ♀ 18-1-38 Dōdi.
Elsewhere noted: *Bhōpal*: Bhōpal Lake. *Gwālior*: Kūno, Satanwāra, Gūna, Rūthiāi. *Indore*: Mhow, Bijwār. *Dhār*: Gūjri, Māndū.
Common. Always near water. Nest with 2 chicks 1 April (Rūthiāi) and another with c/2, fresh, 11 September (Māndū).

Hirundo fluvicola Blyth. The Indian Cliff-Swallow.

Specimen collected : *Gwālior* : 406 o? 2-3-38 Satanwāra.
Elsewhere noted : *Gwālior* : Chandēri. *Indore* : Chōral.
Fairly common. Breeding in April. Large nest colony under arch of masonry bridge 8 April (Chandēri).

Hirundo daurica erythropygia Sykes. Sykes's Striated Swallow.

Specimens collected : *Bhōpal* : 119 ♂, 120 ♂, 121 ♀ 18-1-38 Dōdi. *Gwālior* : 325 ♀, 326 ♂ 20-2-38 Kūno, 455 ♂ 9-3-38 Narwar Fort, 640 ♂, 641 ♂ 11-4-38 Chandēri. *Indore* : 811 ♀, 812 ♂ 7-9-38 Mānpūr.

[All are adults. It is interesting to remark that in this race the tail is in shape and proportions similar to that of the juvenile of the other races. —H.W.]

Fairly common. In small numbers. Breeding in September. Nest with eggs (?) 11-9-38 (Kānkra Kho, Māndū). Old nests also noted at Narwar ♀ 9 March, and at Sānchi, 8-1-38.
Elsewhere noted : *Bhōpal* : Sānchi, Bhōpal town. *Indore* : Bijwār. *Dhār* : Gūjri, Māndū.

Hirundo daurica scullii Seebohm.

Specimen collected : *Gwālior* : 404 2-3-38 Satanwāra.
Elsewhere race not definitely recognised.

[This specimen with its pale rump, warm underparts with very fine streaking and small size (wing 115, central tail feathers 42.5, outer tail feathers 98.5 mm.) clearly belongs to this race (vide Ticehurst, *Ibis* 1933, pp. 547-548) which has not hitherto been recognised so far south in India. It is in fairly fresh plumage with no moult.—H.W.]

Motacilla alba dukhunensis Sykes. The Indian White Wagtail.

Specimens collected : *Gwālior* : 355 ♂ 25-2-38 Satanwāra, 609 ♀ 2-4-48 Chhipon (near Gūna).
Elsewhere noted : *Bhōpal* : Bhōpal town, Dōdi.,*Gwālior* : Gwālior Fort and town, Shivpūri, Chandēri, Bhind. *Indore* : Chōral.
Not abundant but frequent. Earliest date 1 September (Chōral) ; latest 18 April (Bhind).

Motacilla alba personata Gould. The Masked Wagtail.

No specimens.
Noted only at Harsi Lake, Gwālior, 11-3-38—in full summer plumage.

Motacilla maderaspatensis Gmelin. The Large Pied Wagtail.

Specimens collected : *Bhōpal* : 99 ♂ 15-1-38 Dōdi. *Gwālior* : 267 ♂ 12-2-38 Kūno, 354 o? 25-2-38 Satanwāra. *Indore* : 765 ♀, 766 ♂ 1-9-38 Chōral.
Elsewhere noted : *Gwālior* : Harsi Lake, Narwar, Rāmpūra Tank, Gūna, Chandēri. *Dhār* : Māndū.
Fairly common. In small numbers at tanks and rocky streams and rivers. Evidently breeding in April (4 April, Rāmpūra Tank).

Motacilla cinerea caspica (Gmelin). The Eastern Grey Wagtail.

Specimens collected : *Bhōpal* : 195 ♀ 25-1-38 Mathār. *Gwālior* : 499 o? 17-3-38 Surwāya, 593 ♂ 1-4-38 Rūthiāi. *Dhār* : 830 ♂ 9-9-38 Māndū.
Elsewhere noted : *Bhōpal* : Bhōpal Lake, Dōdi, Jaithāri. *Gwālior* : Chandēri. *Indore* : Mandlēshwar. *Dhār* : Gūjri.
Earliest date 5 September (Mandlēshwar) ; latest 8 April (Chandēri). Specimen of 1 April very fat. Nos. 499 and 593 in breeding dress.

Motacilla flava thunbergi Billberg. The Grey-headed Wagtail.

Specimen collected : *Indore* : 791 ♂ 5-9-38 Mandlēshwar.
Elsewhere noted (subspecies?) : *Bhōpal* : Bhōpal Lake. *Gwālior* : Narwar, Chandēri, Bhind.
Earliest date 5 September ; latest 19 April.

Motacilla citreola werae Buturlin. The Yellow-headed Wagtail.

Specimens collected : *Bhōpal* : 83 ♂ 14-1-38 Dōdi. *Gwālior* : 319 ♂ 20-2-38 Kūno, 504 ♂ 18-3-38 Surwāya, 592 ♂ 1-4-38 Rūthiāi.

[Nos. 504 and 592 are just completing the moult into breeding dress. No. 83 is a first winter male.—H.W.]

Elsewhere noted : *Bhōpal* : Bhōpal Lake. *Gwālior* : Satanwāra, Chandēri, Panchamnagar.

On grassy margins of tanks, etc. Latest date 8 April.

Anthus trivialis trivialis Linn. The Tree-Pipit.

Specimens collected : *Bhōpal* : 53 ♂ 10-1-38 Sānchi ; 159 ♀ 21-1-38, 173 ♀ 23-1-38 Mathār. *Gwālior* : 512 ♂, 513 ♀ 19-3-38, 525 ♂ 20-3-38, 534 ♂ 21-1-338 Sūrwāya, 572 ♀ 28-3-38 Badarwās, 607 ♂ 2-4-38 Chhipōn (Gūna Dist.), 880 ♀ 19-9-38 Bāgh.

[Rather dull brownish birds of the type which was separated as *sibirica* though this is really an intermediate which is hardly worth recognition. They intergrade into *haringtoni* but in doubtful cases the thinness of the bill has been the deciding factor.—H.W.]

Anthus trivialis haringtoni Witherby. Witherby's Tree-Pipit.

Specimens collected : *Gwālior* : 677 ♀, 678 ♂ 19-4-38 Bhind.

Elsewhere noted (subspecies?) : *Dhār* : Māndū.

Usually in groves of large trees, e.g. mango and tamarind, and open deciduous forest. Earliest date 10 September ; latest 22 April.

Anthus sordidus jerdoni (Finsch). The Brown Rock-Pipit.

Specimens collected : *Bhōpal* : 250 ♂ 2-2-38 Jaithāri. *Gwālior* : 288 ♂ 16-2-38 Kūno, 340 ♂, 341 ♀ 24-2-38 Satanwāra, 375 ♂ 27-2-38, 539 ♀ 22-3-38 Surwāya.

[It appears to be almost impossible to be certain of separating *jerdoni* and *decaptus* in winter plumage but I think that these specimens belong to the former race. The difficulty is to get hold of a series of freshly moulted birds known to belong to their respective races from which to initiate the comparison. The variations in warmth of colouration may be due to wear and to individual variation.—H.W.]

Not uncommon. In standing wheat-fields, fallow-land and stony sparsely scrubbed country.

Anthus richardi richardi Vieill. Richard's Pipit.

Specimen collected : *Gwālior* : 636 ♂ 9-4-38 Chandēri.

Solitary on wet grassy tank margin.

Anthus campestris thermophilus Jerdon. The Tawny Pipit.

Specimens collected : *Bhōpal* : 87 ♂ 14-3-38 Dōdi. *Gwālior* : 304 ♂, 306 ♀ 19-2-38 Kūno, 332 ♂ 24-2-38 Satanwāra, 436 ♂ 7-3-38 Narwar, 552 ♂ 26-3-38 Badarwās, 654 ♂, 655 ♂ 656 ♂ 17-4-38, Bhind. *Dhār* : 838 ♀ 11-9-38 Māndū.

Anthus campestris griseus Nicoll. The Eastern Tawny Pipit.

Specimens collected : *Bhōpal* : 39 ♂ 9-1-38 Sānchi ; 86 ♂ 14-1-38, 94 ♂, 95 ♀ 15-1-38, 133 ♀ 18-1-38 Dōdi. *Gwālior* : 305 ♂ 19-2-38 Kūno, 333 o? 24-2-38, 348 ♀ 25-2-38 Satanwāra, 514 ♂ 19-3-38, 540 ♂ 22-3-38 Surwāya, 550 ♀, 553 ♀ 26-3-38, 25-3-38 579 ♀ 29-3-38 Badarwās, 657 ♀, 658 ♀ Bhind. *Dhār* : 854 ♀ 13-9-38 Māndū.

Fairly common. Specimens of 17 April (latest date) mostly very fat. On 17 September, by which date the birds were well in, flocks observed arriving from north direction (Sardārpūr, Gwālior).

Anthus rufulus waitei Whistler.

Specimens collected : *Bhōpal* : 249 ♀ 2-2-38 Jaithari. *Gwālior* : 635 ♂ 9-4-38 Chandēri, 863 ♀ 16-9-38 Sardārpūr. *Indore* : 789 ♀, 790 ♀ 5-9-38 Mandlēshwar,

[These specimens confirm the opinion which I expressed in *J.B.N.H.S.*, xxxviii, 765 that the range of this race extended through Sind and Rajputana to the Narbada River.—H.W.]

Fairly common. Evidently breeding in April. Testes of No. 635, 5×4 mm.

Anthus roseatus Hodgs. Hodgson's Pipit.

Specimens collected: *Gwālior*: 407 ♀, 408 o?, 409 ♂ 2-3-38 Satanwāra. On grassy edge of tank.

Alauda gulgula punjaubi Whistler. The Punjab Skylark.

Specimen collected: *Gwālior*: 361 ♀ 26-2-38 Satanwāra.
Elsewhere noted: *Bhōpal*: Jaithāri.
About grassy tank margins and standing wheat crops. Soaring and singing (February).

Calnadrella brachydactyla longipennis (Eversm.). The Yarkand Short-toed Lark.

Specimens collected: *Gwālior*: 330 ♂ 24-2-38 Satanwāra, 653 ♂ 17-4-38 Bhind.
Elsewhere noted: *Bhōpal*: Sānchi, Dōdi, Jaithāri.
Less common than the next.

Calandra acutirostris Hume. Hume's Short-toed Lark.

Specimens collected: *Bhōpal*: 247 ♀ 2-2-38 Jaithāri. *Gwālior*: 346 ♀, 347 ♂ 25-2-38, 359 ♂, 360 ♀ 26-2-38 Satanwāra; 516 ♀ 19-3-38 Surwāya; 542 ♀ 25-3-38 Badarwās.
Common. Flocks in semi-desert and fallow land about cultivation, often in association with the foregoing species. By the end of September, Short-toed Larks had evidently not arrived in Central India.

Mirafra javanica cantillans Jerdon. The Singing Bush-Lark.

Specimens collected: *Bhōpal*: 92 ♂ 15-1-38 Dōdi, 190 ♂ 25-1-38 Mathār.

Mirafra erythroptera erythroptera Jerdon. The Red-winged Bush-Lark

Specimens collected: *Bhōpal*: 46 o? 9-1-38 Sānchi; 72 ♂, 73 o? 14-1-38 90 ♂, 91 ♂ 15-1-38 Dōdi; 231 o? 31-1-38 Jaithāri. *Gwālior*: 277 ♂ 14-2-38 281 ♂ 15-2-38 Kūno, 358 ♀ 25-2-38 Satanwāra, 474 ♂ 16-4-38, 477 ♂ 14-3-38 Narwar Fort, 544 ♂ 26-3-38 Badarwās, 652 ♂ 16-4-38 Bhind. *Indore*: 764 ♀ 1-9-38 Chōral. *Dhār*: 779 ♀ 4-9-38 Gūjri.
Generally distributed; on stony, arid thinly scrubbed or straggly grass-covered country. Both species in the same facies. Testes of specimen on 16 April enlarged to 4×3 mm.

Galerida deva (Sykes). Sykes's Crested Lark.

Specimens collected: *Bhōpal*: 93 o? 15-1-38 Dōdi. *Dhār*: 839 ♂, 840 ♂ juv., 841 ♀, 842 ♂ juv., 843 ♀ 11-9-38 Māndū. *Gwālior*: 861 ♂ 15-9-38, 864 ♂, 865 ♂ 16-9-38, 873 ♀ 17-9-38 Sardārpūr.
[The two juveniles—Nos. 840 and 842—are crestless. They have the general colouration of the adults but differ like other juvenile larks in having the upper parts squamated, owing to most of the feathers having a narrow terminal fringe of pale fulvous.
The adults of this series are all in rather worn plumage with no sign of moult. I have now examined a good many specimens of this lark but have so far only found them undergoing their complete moult (which is presumably post-nuptial) in March, April and May. This requires explanation and it is evident that we do not yet know the full life-history of this species.
Mr. Sálim Ali collected samples from Māndū and Sardārpūr of the soil on which these larks were found, and though the samples from the two localities differ rather in colour they are both very dark and agree fairly well with the colour of the lark. I have in my own collection five other soil samples

collected with this lark in the neighbourhood of Mhow by the Rev. Frank S. Briggs in the years 1927-1929. All these are also dark soils, four of them being practically black. It would be interesting to verify that this lark is found on dark soil throughout its range.—H.W.]

Patchily distributed. Gregarious, on stony sparsely scrubbed country—*Mirafra* facies. September specimens all had their gonads enlarged and were breeding. Many juveniles were being fed by parents.

Ammomanes phœnicura phœnicura (Franklin). The Indian Rufous-tailed Finch-Lark.

Specimens collected: *Bhōpal*: 40 ♂ 9-1-38, 59 ♂ 10-1-38 Sānchi. *Gwālior*: 292 ♀, 293 ♂ 16-2-38 Kūno. *Dhār*: 853 ♀ 13-9-38 Māndū.
Fairly common on fallow land, etc. in open cultivated country. Gonads maturing in specimens of 16 February. In flocks of up to 50 or more in September.

Eremopterix grisea siccata (Ticehurst). The Ashy-crowned Finch-Lark.

Specimens collected: 234 ♂, 235 ♂, 236 ♀ 31-1-38 Jaithāri. *Gwālior*: 331 ♂ 24-2-38 Satanwāra, 866 ♀ 16-9-38 Sardārpūr. *Indore*: 762 ♀ 1-9-38 Chōral.

[Most of these birds come from near the boundary line between the typical race and *siccata* and are therefore slightly intermediate in character but all the same they may be definitely attributed to the latter.—H.W.]

Fairly common on waste and fallow land about cultivation. Apparently breeds throughout the year. Gonads of all specimens mature. In September in mixed flocks with *Ammomanes*.

Zosterops palpebrosa occidentis Ticehurst. The White-eye.

Specimens collected: *Bhōpal*: 239 ♀, 240 ♀ 1-2-38 Jaithāri. *Gwālior*: 446 ♂ 8-3-38 Narwar Fort, 498 ♂ 17-3-38 Sūrwāya 508 ♂ 18-3-38, 595 ♂ 1-4-38 Rūthiāi. *Indore*: 732 ♀ 29-8-38 Chōral.
Elsewhere noted: *Bhōpal*: Bhōpal town environs, Sānchi. *Gwālior*: Gwālior Fort, Satanwāra, Shivpūri, Chandēri, Sardārpūr. *Dhār*: Māndū.
Common in gardens and wooded country.

Cinnyris asiatica asiatica (Lath.). The Indian Purple Sunbird.

Specimens collected: *Bhōpal*: 238 ♂ 1-2-38 Jaithāri. *Gwālior*: 401 ♀ 1-3-38 Satanwāra, 510 ♀ 18-3-38 Sūrwāya, 548 ♂ 25-3-38 Badarwas, 661 ♂, 662 o? 17-4-38 Bhind. *Dhār*: 796 o? 5-9-38 Gūjri.
Common. Gonads of March and April specimens mature. Nest-building 26 March. Nest with 2 chicks, about 5 days old, 31 March. Juveniles ex nest 19 April.

Piprisoma agile agile (Tickell). The Thick-billed Flowerpecker.

Specimens collected: *Bhōpal*: 222 ♂ 30-1-38, 242 ♀ 1-2-38 Jaithāri. *Gwālior*: 605 o? 2-4-38 Chhipōn. *Dhār*: 803 ♂ 6-9-38 Gūjri.
Fairly common. Invariably on Banyan, Peepal and *Loranthus* in ripe fruit. Gonads of January and February specimens maturing.

Pitta brachyura (Linn.). The Indian Pitta.

Specimens collected: *Indore*: 717 ♂ juv. 25-8-38 Bijwār. *Dhār*: 780 ♀ 4-9-38, 805 ♀ 6-9-38 Gūjri.

[All three specimens are young birds with the post-juvenal body moult well advanced; the lesser and median wing coverts are being moulted but there is no moult in the remiges or rectrices.—H.W.]

Elsewhere noted: *Dhār*: Māndū, Dhār town environs. *Gwālior*: Tānda (near Sardārpūr).
Evidently a breeding monsoon visitor. None met with in Central India between January and May.

(*To be continued*).

STUDY OF THE SEX ORGANS OF MAHSEER (*BARBUS TOR.*[1] H.B.).

BY

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In Europe, America and elsewhere a good deal of information has been collected and published on the natural history of fishes. Buckland (1883), for instance, in his book on 'Natural History of British Fishes', deals exhaustively with their 'structure, economic uses and their capture by net and rod'; while Norman (1931) in his recent work on 'A History of Fishes', supplies information on such questions as locomotion of fishes, their age, population, breeding, etc., and Jordan (1925) in his 'Fishes', has tried 'to compress all that an educated man is likely to know, or care to know, about fishes', and treats with 'considerable fulness', 'each one of the food and game fishes of the United States.'

In India, however, our knowledge regarding the natural history of Indian fishes is very meagre, and, for lack of such knowledge, very little authentic information is available regarding the breeding season of the various species. Dunsford (1911), in his report 'On Fish and Fisheries of the Punjab', commenting upon the question of a close season for catching fish, remarks, regarding the breeding time of the Indian fishes, 'Conjectures and surmises exist in plenty, some of which express the belief of experts and are, therefore, entitled to respect but there has been nothing recorded which can be accepted as absolutely proved regarding this matter. By epitomising such knowledge and opinions as do exist, we may perhaps arrive at conclusions which are sufficient to furnish a basis for present action.'

For example, taking the case of Mahseer, one of the most important game and food fishes of India, very little is definitely known regarding its breeding habits. Beevan (1877) says: 'When the rains begin these fish commence moving up the streams for spawning purposes. . . . The Mahseer, and many other Cyprinoid fish, are said not to deposit their spawn all at once, like the

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[1] 'The status of *Barbus tor* is not correctly known and it is probable that a number of large scaled *Barbus* of India are now included under this specific name. Further it is quite possible that as in the Eastern Himalyas, we have various species of *Barbus*, i.e. *B. putitora* (Hamilton) in which the head is considerably larger than the depth of the body, *B. tor* (Hamilton) in which the head is considerably shorter than the depth of the body and *B. hexatichus* (McClelland) in which the length of the head equals depth of the body. The data presented in this paper show that the 'Mahseer' breeds thrice a year in the Punjab hills and it is quite possible that the three species enumerated above breed at different times of the year and if detailed information is collected species by species from different localities throughout India wherever the Mahseer is found it may be possible to clear up the breeding season of the various species included under Mahseer.'

Salmon, but in small batches during a period of several months, say from May to August.' Thomas (1897) remarks: 'Careful examination of the ovaries of many fish has satisfied me that the Mahseer does not spawn like the Salmon all at one time, but just as a fowl lays an egg a day for many days, so in my opinion the Mahseer lays a batch of eggs at a time, and repeats the process several times in a season. How many batches it lays in a season cannot be positively said, but I should judge from the appearance of the ovaries that there were three batches.' Dunsford (1911) asserts that, 'In the Kumaon lakes, Mahseer most certainly breed at the commencement of the rains. I have taken them there frequently of both sexes, ready for spawning operations, in July, just after the rainy season commenced.' Nevill (1915) states: 'I have caught female Mahseer with well developed roe during several months of the year. I have seen fish at different times of the year working themselves over gravel and small stones in tributary streams and in very shallow waters. I imagine they were working out the gravel and small stones for the reception of eggs.' Sir Reginald Spence and Prater (1933), commenting on the breeding of the Mahseer, remark: 'How many batches of eggs the Mahseer lays in one season is not known.'

In order to acquire some scientific data regarding the breeding season of the Mahseer, collections of the sex organs of the Mahseer were made from different localities in the Punjab from 1929 to 1931, and their study reveals some interesting results, which, together with such field observations as were actually made on the streams, are presented in this paper.

The sex organs, preserved in 5 per cent formalin, were collected from Kangra, Gurdaspur, Hoshiarpur, Jhelum and Rawalpindi Districts by the Fisheries Staff stationed there, to whom I express my appreciation.

The results of the examination of the sex organs of the Mahseer are tabulated in Table I and II, showing the condition of the ovaries and testes respectively during various months of the year.

In *January*, the ovaries were full of eggs to their entire extent, and each egg measured 1.5 mm. to 2.5 mm. in diameter. Testes were also swollen and full of milt. In *February*, in almost all cases, the ovaries were empty. In *March*, eggs were again seen in the ovaries, present in their entire length, but of small size. In *April*, again the same condition prevailed. In *May*, the ovaries contained eggs of all sizes and the testes were filled with milt. It was observed that the milt was present in a male Mahseer measuring 8″ in length, while ova were not found in females less than 12″ in length. In *June*, the ovaries were invariably empty. In *July*, some of the ovaries examined were empty and shrunk, and some had eggs throughout their entire length. The ovaries, were, however, not swollen with eggs. Testes, too, were either empty or were slightly swollen with milt. In *August*, the eggs had attained their maximum size, measuring 2 to 3 mm., in diameter. Towards the end of August, some of the ovaries were again empty. Some of the testes were full of milt and others empty. A female 32″ long caught from the River Ravi

TABLE I. STUDY OF OVARIES OF THE MAHSEER

Date	Locality	Measurement of Fish		Weight of Ovaries	Condition of Ovaries and Eggs
		Length	Weight		
11- 1-31	Nigul (River Beas, Kangra) ...	24″	...	36 gm.	Full of eggs, all of the same size: 1·5 mm., in diameter.
12- 1-29	River Jhelum near Malakwal ...	32″	6 srs.	239 gm.	Full to the entire extent, egg 1·5 to 2·5 mm., lying mixed together throughout the ovaries.
26- 1-31	Rawalpindi ...	19·5″	15 chk.	40 gm.	Full to their entire extent, egg 2 to 2·5 mm.
3- 2-31	River Sohan, (Rawalpindi) ...	14″	10 chk.	...	Empty.
12- 2-31	River Haro, (Rawalpindi) ...	27″	3 srs.	85 gm.	Empty at their lower ends, very much shrunk, a few eggs present, 1 mm., in diameter.
18- 2-31	Jaugal, (Kangra) ...	18″	...	8 gm.	Almost entirely empty, only a few eggs 1 mm., in diameter.
18- 2-31	Jaugal, (Kangra) ...	18″	...	4 gm.	Shrunk, almost entirely empty, a few eggs, ·8 mm., in diameter.
26- 2-30	River Beas, (Kangra) ...	20″	2¼ srs.	4 gm.	Entirely empty.
7- 3-31	River Kurung, (Rawalpindi) ...	21½″	1½ sr.	24 gm.	Eggs present in the entire length, 1 to 1·5 mm., in diameter,
13- 3-31	River Chablat, (Rawalpindi) ...	14″	½ sr.	17½ gm.	Full of eggs, 1 to 1·5 mm., each.
20- 3-29	River Jhelum ...	25″	2½ srs.	39 gm.	Eggs present in the entire length, 1 to 2 mm., each.
8- 4-29	River Jhelum ...	37″	4¼ srs.	35 gm.	Both ovaries entirely empty.
12- 4-32	River Jhelum ...	17½″	17 chk.	10 gm.	Both ovaries empty.
18- 4-29	River Jhelum ...	32″	4 srs.	84 gm.	Eggs 1 to 2 mm., in diameter present in the entire length.
8- 5-29	Rawalpindi ...	17½″	½ sr.	23 gm.	Eggs 1 to 1·5 mm., each present in the entire length.
8- 5-29	Rawalpindi ...	19″	½ sr.	12½ gm.	Eggs 1 to 1·5 mm., each, present in the entire length.
13- 5-29	River Jhelum ...	30″	4 srs.	44 gm.	Eggs 1 to 2 mm., each, present in the entire length.
21- 6-29	River Haro, (Rawalpindi) ...	19½″	½ sr.	12 gm.	Very few 1 to 1·5 mm., eggs, ovaries almost entirely empty.
24- 6-29	River Kurung, (Rawalpindi) ...	20½″	1 sr.	8 gm.	Almost entirely empty, a few 1 mm., eggs.
25- 6-29	River Chablat, (Rawalpindi) ...	27″	2½ srs.	11 gm.	Entirely empty.
1- 7-29	River Jhelum ...	27″	2¾ srs.	17 gm.	Entirely empty.
1- 7-29	River Jhelum ...	29″	3 srs.	17 gm.	Entirely empty.
3- 7-30	River Beas, (Kangra) ...	16″	1½ sr.	48 gr.	Empty and shrunk.
20- 7-30	River Beas, (Kangra) ...	11½″	½ sr.	13 gr.	Empty and shrunk.
20- 7-30	River Beas, (Kangra) ...	13½″	¾ sr.	38 gr.	Empty and shrunk.
20- 7-30	River Beas, (Kangra) ...	13½″	¾ sr.	32 gr.	Empty and shrunk.

TABLE I. STUDY OF OVARIES OF THE MAHSEER—*contd.*

Date	Locality	MEASUREMENT OF FISH		Weight of Ovaries	Condition of Ovaries and Eggs
		Length	Weight		
16– 7–29	River Beas, (Kangra) ...	29″	6½ srs.	128 gm.	Full of eggs, number of eggs 50,960, each 1·5 to 2 mm., in diameter.
22– 7–31	Rawalpindi ...	20″	1¾ sr.	14 gm.	Full of eggs, each 1 mm., to 1·5 mm., but not swollen.
22– 7–31	Rawalpindi ...	42″	12½ srs.	92 gm.	Full of eggs, but not swollen, each egg 1 to 2 mm., in diameter.
26– 7–30	River Beas, (Kangra) ...	17″	2 srs.	220 gr.	Empty.
26– 7–30	River Beas, (Kangra) ...	26½″	5 srs.	267 gr.	Empty.
31– 7–29	River Jhelum ...	39″	9½ srs.	68 gm.	Full of eggs, each egg 1 to 1·5 mm., in diameter.
4– 8–29	Jugal, (Kangra) ...	20″	...	46 gm.	Full of eggs, ovaries fully swollen, each egg 1·5 to 2·5 mm.
4– 8–29	Sohan, (Rawalpindi) ...	23½″	2½ srs.	71 gm.	Full of eggs, each egg 2 to 2·5 mm., in diameter.
7– 8–30	River Beas, (Kangra) ...	33″	9½ srs.	3550 gr.	Full of eggs, total number 68,599.
11– 8–30	Nigul, (Kangra) ...	14″	...	...	Full of eggs, each egg 3 mm., in diameter.
13– 8–29	River Ravi, (Madhopur) ...	...	...	192 gm.	Full of eggs, each 2 to 3 mm.
14– 8–30	River Beas, (Kangra) ...	15″	1 sr	30 gr.	Empty.
16– 8–30	River Beas, (Kangra) ...	12¾″	½ sr.	20 gr.	Empty.
17– 8–29	River Jhelum ...	38″	8½ srs.	80 gm.	Almost entirely empty.
27– 8–30	Binnawan, (Kangra) ...	14″	...	12 gm.	Almost entirely empty.
8– 9–31	Baner, (Kangra) ...	30″	7 srs.	122 gm.	Full of eggs, each 2 to 3 mm., in diameter.
10– 9–31	Baner, (Kangra) ...	14″	...	20 gm.	Fully ripe, eggs 1·5 to 2 mm., each.
14– 9–31	Baner, (Kangra) ...	15″	...	20 gm.	Full of eggs, each 1·5 to 2 mm.
15– 9–30	River Beas, (Kangra) ...	32½″	7½ srs.	22 tola.	Both ovaries swollen with eggs. Number of eggs 56,848, each 2 to 3 mm.
15– 9–30	River Beas, (Kangra) ...	14¾″	¾ sr.	33 gr.	Empty.
15– 9–30	River Beas, (Kangra) ...	12″	½ sr.	14 gr.	Empty.
5–10–29	River Beas, (Kangra) ...	24″	2½ srs.	33 gm.	Almost entirely empty, only a few eggs each 1 to 1·5 mm.
16–10–30	River Beas, (Kangra) ...	13¾″	¾ sr.	34 gr.	Empty.
16–10–30	River Beas, (Kangra) ...	15½″	1 sr.	45 gr.	Empty.
4–12–30	River Beas, (Kangra) ...	17½″	1 sr.	64 gr.	Empty.
4–12–30	River Beas, (Kangra) ...	23½″	2½ sr.	130 gr.	Empty.
14–12–30	River Kurang, (Rawalpindi) ...	16″	1 sr.	...	Empty.
18–12–30	River Beas (Kangra) ...	12″	...	...	Empty.

TABLE II—STUDY OF THE TESTES OF THE MAHSEER

Date	Locality	Measurement of fish		Weight of testes	Condition of testes.
		Length	Weight		
26– 1–32	Binnwan (Kangra)	19″	1⅛ sr.	40 gr.	With milt, slightly swollen.
26– 1–32	Binnwan (Kangra)	19″	1⅛ sr.	96 gr.	Fully swollen with milt.
26– 1–32	Binnwan (Kangra)	18″	1 sr.	...	Full of milt.
26– 1–32	Binnwan (Kangra)	16″	1 sr.	20 gr.	Empty.
26– 1–32	Binnwan (Kangra)	17″	1 sr.	3·5 gm.	Full of milt.
26– 1–32	Binnwan (Kangra)	15½	⅞ sr.	1·5 gm.	Empty.
26– 1–32	Binnwan (Kangra)	15″	¾ sr.	1 gm.	Empty.
26– 1–32	Binnwan (Kangra)	14″	⅝ sr.	1 gm.	Empty.
26– 1–32	Binnwan (Kangra)	14½″	⅝ sr.	1 gm.	Empty.
12– 3–31	Chablat River (Rawalpindi)	12″	⅜ sr.	11 gr.	Full of milt.
12– 3–31	Chablat River	11″	⅜ sr.	10 gr.	Full of milt.
12– 3–31	Beas River (Kangra)	36″	4 sr.	25 gm.	Fully ripe, full of milt.
10– 4–32	Beas (Kangra)	16″	13 chk.	...	Empty.
8– 5–29	Rawalpindi	16½″	½ sr.	6 gm.	Empty.
6– 6–31	Nigul (Kangra)	12½″	⅜ sr.	3 gm.	Full of milt.
3– 7–30	Beas (Kangra)	13″	¾ sr.	22 gr.	Empty.
20– 7–30	Beas (Kangra)	16″	1½ sr.	5 gm.	Empty.
26– 7–30	Beas (Kangra)	15″	1½ sr.	90 gm.	Full of milt.
7– 8–30	Beas (Kangra)	19½″	2½ sr.	74 gr.	Full of milt.
7– 8–31	Nigul (Kangra)	15″	¾ sr.	21 gm.	Full of milt.
11– 8–30	Karani Nal (Kangra)	12″	...	...	Full of milt, swollen.
15– 8–31	Baner (Kangra)	16″	¾ sr.	12 gm.	Full of milt.
16– 8–30	Beas (Kangra)	13½″	¾ sr.	11 gm.	Full of milt.
27– 8–30	Binnwan (Kangra)	12″	...	18 gm.	Full of milt.
1– 9–30	Batwali (Kangra)	16″	...	22 gm.	Full of milt.
6– 9–30	Beas (Kangra)	18¼″	1½ sr.	405 gr.	Full of milt. Milt escaped while weighing.
6– 9–30	Beas (Kangra)	16″	1 sr.	410 gr.	Fully ripe.
10– 9–31	Baner (Kangra)	15″	...	9 gm.	Full of milt.
6–10–31	Beas (Kangra)	16″	...	12 gm.	Full of milt.
26–10–31	Jugal (Kangra)	13½″	¼ sr.	11 gm.	Full of milt.
26–10–31	Jugal (Kangra)	11¼″	⅜ sr.	...	Empty.
26–10–31	Jugal (Kangra)	13¼″	¼ sr.	...	Empty.
26–10–31	Jugal (Kangra)	13½″	¼ sr.	3 gm.	Empty.
18–12–30	Mandh (Kangra)	14″	...	2 gm.	Empty.
18–12–30	Mandh (Kangra)	12″	...	...	Empty.

(Madhopur) in August was found to be quite 'spent', and another female 24″ long had few ripe ova at the upper part of the ovaries, while the lower portion was empty, showing, thereby, that the spawn had been laid. In *September,* some ovaries had fully ripe ova and others were found to be empty. Testes were full of milt. From Jugal Khad near Nagrota (Kangra) on the 15th September, temperature of water ranging from 79°F. to 80°F., four female Mahseer were caught and were found to be spent up. Another female 20″ long, when dissected, showed very few small sized eggs in its ovaries. The eggs were all of uniform size and measured less than 1 mm. in diameter. Its belly was flabby, evidently it was also spent. Very minute Mahseer fry were seen in the said stream on that date. From *October* to *December* the ovaries were invariably almost entirely empty.

There is thus strong evidence to show that the Mahseer spawns more than once during the year. Most of the Indian Carps, such as *Labeo rohita, Labeo calbasu, Cirrhina mrigala, Catla catla* and others spawn in June and July when the rivers are flooded with the monsoon rains and lay their eggs in one batch once in the year (Hamid Khan, 1924). The Mahseer, however, as a study of its sex organs reveals, seems to spawn *firstly*, in winter, in January and February, *secondly*, in May and June, when the snow melts and the rivers are swollen, and *thirdly*, from July to September, when the rivers are flooded with the monsoon rains. It is for this very reason that fry of the Mahseer of all ages is seen during the whole of the year in the hill streams of Kangra, Hoshiarpur, Jhelum and Rawalpindi Districts.

There is, however, hardly any evidence to corroborate the views of Thomas (1897) that the Mahseer lays its eggs in batches, 'just as a fowl lays an egg a day for many days.' The simile does not appear to be appropriate, as in the case of the Mahseer all the eggs contained in the ovaries seem to be laid at the spawning time and the ovaries become empty. At the approach of the next spawning season the ova reappear, increase in size, swell the ovaries and are laid again. It may, therefore, be said that the Mahseer does not lay its eggs in three batches, but that it spawns three times in the year, and that all the eggs in the ovaries are laid at each spawning season.

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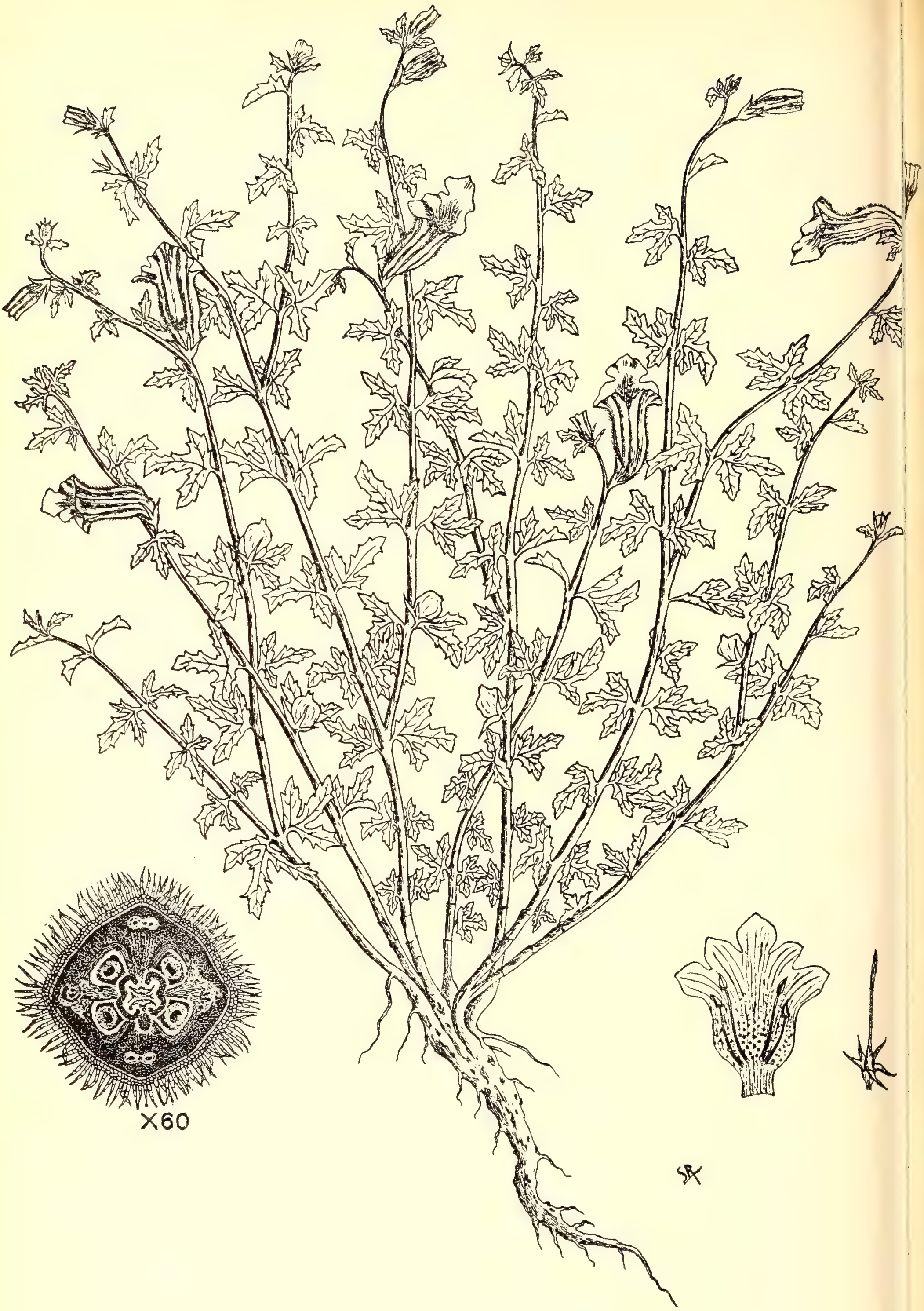

Sayeedud-Din—*Sesamum laciniatum* Klein. × ½

PEDALIACEÆ.

(*For explanation see end of ar le*).

SOME COMMON INDIAN HERBS WITH NOTES ON THEIR ANATOMICAL CHARACTERS.

BY

M. Sayeedud-Din,

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(With three plates).

I.—Sesamum laciniatum Klein.

(PEDALIACEÆ).

Systematic Description.

Sesamum laciniatum Klein.; Willd. sp. Pl. iii, 359; DC. Prodr., ix. 209; Wight Ic. t. 1345; H.F.B.I., iv, 387 (Plate I and Plate II, Fig. 1), is a prostrate, hairy herb, abounding in mucilage. Leaves elliptic, deeply pinnatifid with acute laciniations. Corolla finely pubescent, purple, yellow in the palate. Ovary incompletely 4-celled by the intrusion of the placentae. Capsule scabrous-pilose, rounded, shortly mucronate at the apex, dorsally compressed. Flowers in the rainy season about July and August.

Habitat.

Common towards South Deccan Peninsula. Rare in the Bombay Presidency. It grows almost under xerophytic conditions on sandy and rocky soil.

Anatomical Notes.

The structure of the glandular hairs seems to be very characteristic of the Pedaliaceae by which it can readily be distinguished from allied families. Many members of this family, viz. *Trapella, Pretrea, Josephinia, Ceratotheca, Martynia diandra* Glox., *Pedalium murex* Linn., and *Sesamum indicum* Linn. have already been investigated. In the available literature no reference is found regarding the structure of the glands and the hairy covering in *Sesamum laciniatum* Klein.

All parts of the plant possess calcium oxalate crystals which are either solitary or clustered. Leaf is bifacial and possesses stomata on both sides. Mucilage glands (Pl. II, Fig. 2 and Pl. III) are more abundant in the epidermis of the leaf, especially on the lower side, than in that of the stem. Moreover there are absorbing hairs with entire and also with divided heads like those in the stem. (Pl. III, Fig. 1, b and c.) The trichomes are of two kinds—ordinary hairs, and glandular hairs with long uniseriate stalk and a spherical head (Pl. III, Fig. 2, b). Another striking feature of the leaf is that the epidermal cells are enlarged at certain places. Possibly it is a water storing device (Pl. III, Fig. 2, a).

In the epidermis of the stem three different kinds of hairs are present, viz., ordinary multicellular, long uniseriate hairs which are broad at the base and gradually narrow down towards the apex, and end in a more or less sharp point (Pl. III, Fig. 1, a); there are other trichomes with rounded head (Pl. III, Fig. 1, a); again there are absorbing hairs which possess a uniseriate stalk of varying length bearing a spherical head which is generally divided by two vertical walls (Pl. III, Fig. 1, b). In addition to these there are mucilage glands (Pl. III, Fig. 1, e) which are not so plentiful as in other parts. The mucilage gland consists of a one-celled stalk and a peltate head which has four cells arranged crosswise with their walls projecting convexly at the margin of the head. No striations could be detected in the cells like those illustrated by Solereder in the case of *Sesamum indicum* Linn. In the presence of water the glands swell up and break off from the stalks.

On the outer side of the calyx also ordinary hairs, absorbing hairs, and fewer mucilage glands are present. Some of the ordinary trichomes are constricted in the middle. These are also found on the stem and on the corolla. The heads of some of the hairs fall off, leaving the stalks.

Trichomes, absorbing hairs and mucilage glands are found on the upper and lower sides of the corolla (Pl. III, Fig. 3). Stamens also possess mucilage hairs on the lower sides of the anthers facing the filament. The cells are more or less empty and transparent. There are very few scattered ordinary trichomes (Pl. III, Fig. 4).

Mucilage glands are most abundant on the outer wall of the ovary and in the epidermis of the fruit. Ordinary hairs and absorbing hairs are also present.

CONCLUSIONS.

Systematists depend chiefly on the floral characters to distinguish one family from the other. Since the progress of anatomical research ample evidence is forthcoming to show that anatomical characters too offer important diagnostic clues in the identification of families. In the present case, viz., the investigation of the mucilage glands in many genera and species of Pedaliaceae shows that these structures are a typical and distinguishing feature of this family. Although mucilage glands are found in other families too, viz., Plumbaginaceae and Polygonaceae, the structure of the glands in Pedaliaceae is quite distinct from that of the others.

ACKNOWLEDGMENTS.

I am indebted to Mr. Sri Ram Loo for the illustrations which were prepared under my supervision. Mr. M. Moinuddin has helped me in the preparation of the slides for which I am thankful to him.

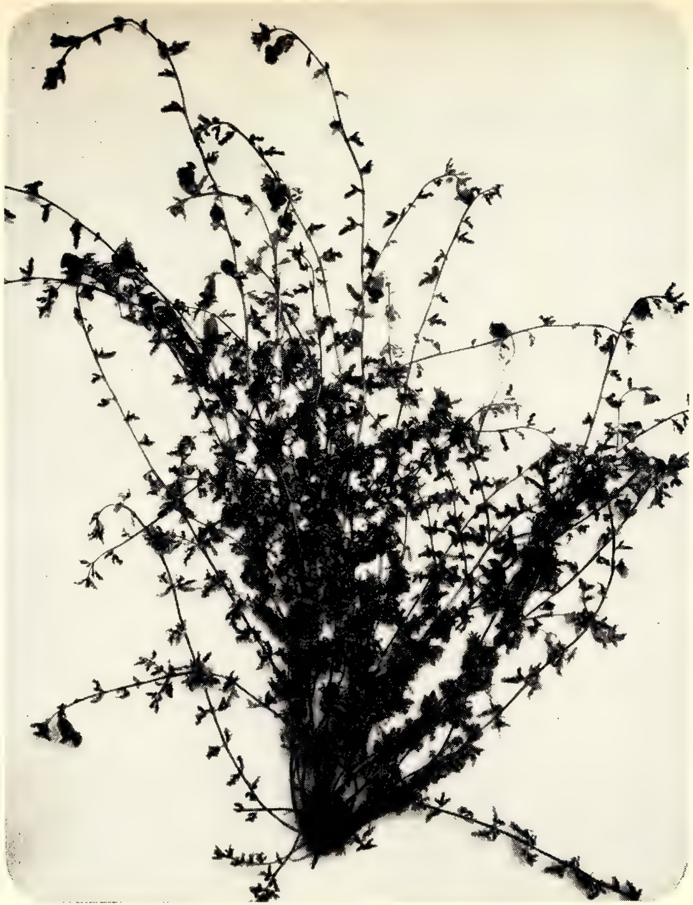


Fig. I

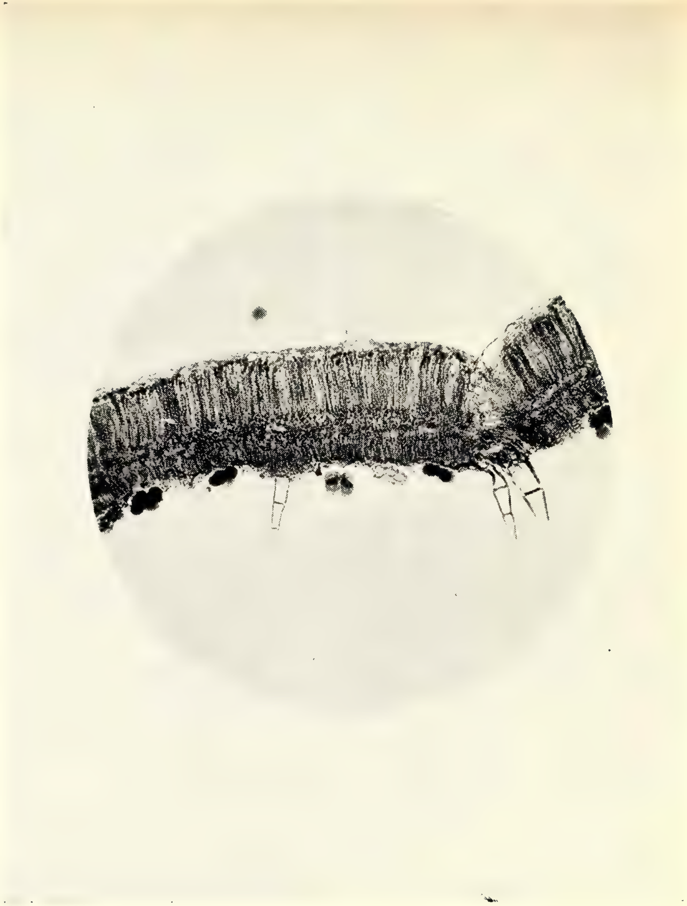
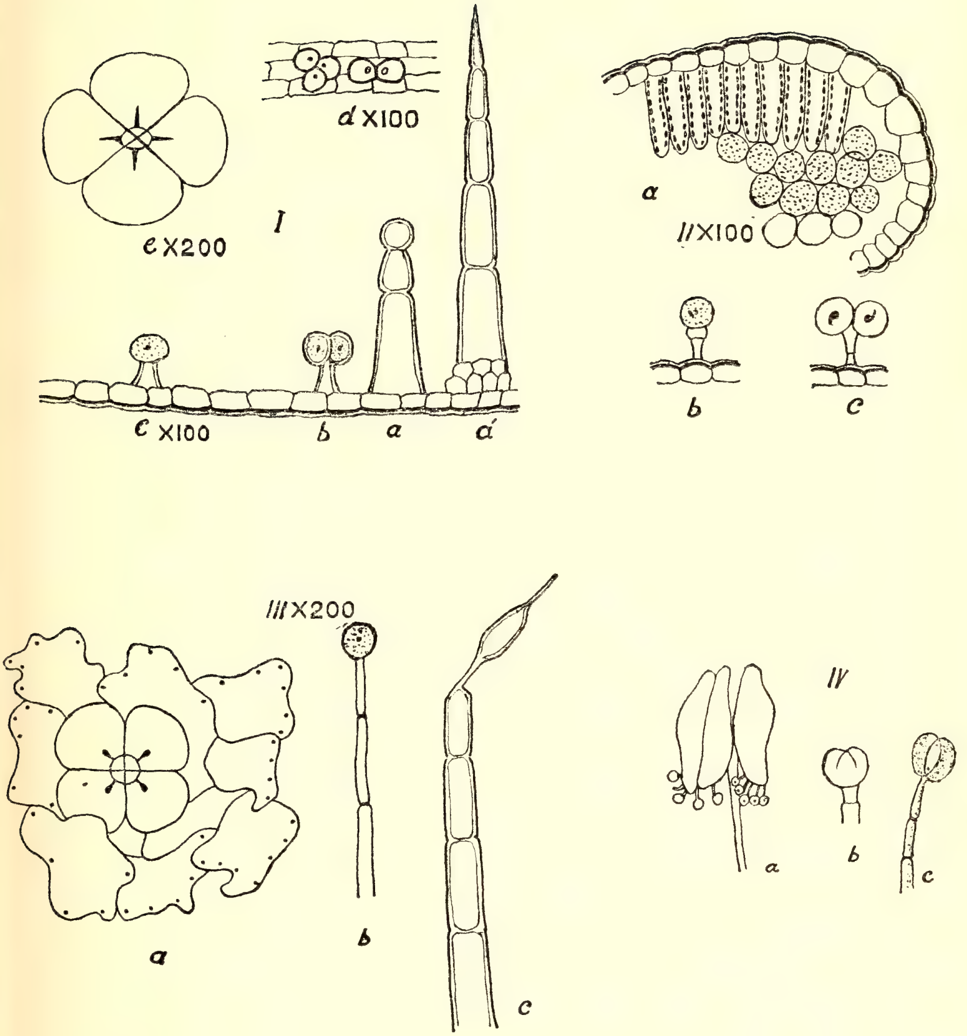


Fig. II

Sesamum laciniatum Klein.
(*For explanation see end of article*).


e X200
d X100
I
e X100
b
a
a'
a
II X100
b
c
III X200
a
b
c
IV
a
b
c

Sayeedud-Din *Sesamum laciniatum* Klein.

(*For explanation see end of article*).

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EXPLANATION OF PLATES I TO III.

Illustrating M. Sayeedud-Din's paper on 'Some Common Indian Herbs with notes on their Anatomical Characters.' I. *Sesamum laciniatum* Klein.

PLATE I.

Black and white sketch of *Sesamum laciniatum* Klein. (×½), showing—right, opened out corolla and gynaeceum; left, transverse section of ovary (×60).

PLATE II.

Fig. 1.—Photograph of *Sesamum laciniatum* Klein.
Fig. 2.—Photograph of transverse section of leaf, showing trichomes and mucilage glands.

PLATE III.

Fig. 1.—Stem—epidermis. a, a′, trichomes; b, absorbing hair with divided head; c, same with entire head (×100) d, surface view of absorbing hairs (×100); e, mucilage gland in surface view (×200).
Fig. 2.—T.S. leaf, showing: a, enlarged epidermal cells; b, glandular hair; c, mucilage gland in side view (×100).
Fig. 3.—Corolla—epidermis. a, mucilage gland; b, glandular hair; c, ordinary trichome (×200).
Fig. 4.—Stamen—a, showing position of glandular hairs and trichomes on the anther-lobes; b and c, glandular hairs (×120).

CORACLES AND CHIMPANZEES.

BY

LIEUT.-COLONEL R. W. BURTON.

(*With two plates*).

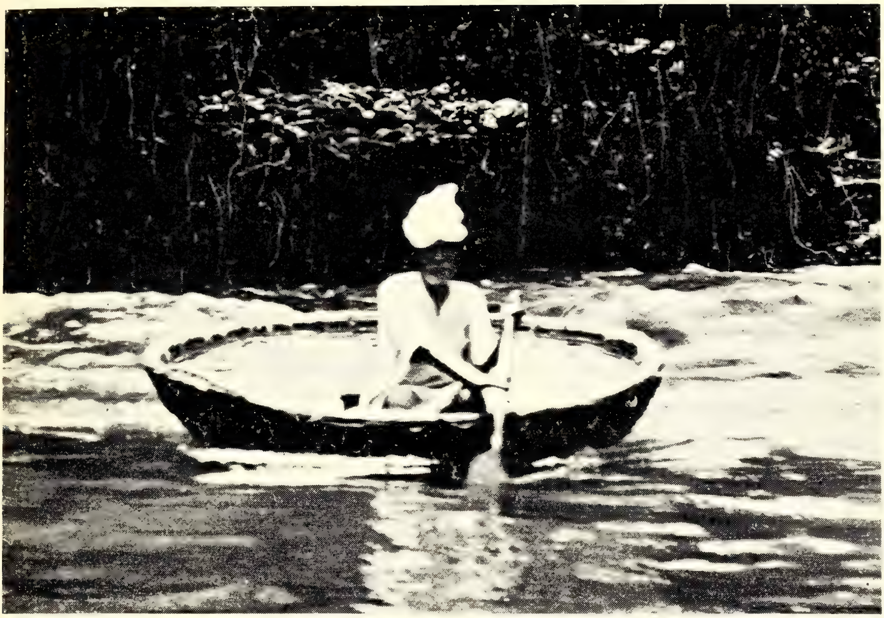
At Whipsnade the Great White Lion invites the visitor from afar to view the many zoological treasures in the beautiful Park where are to be observed animals and birds from distant lands; and there also you may see the chimpanzees with their keeper taking afternoon tea in quite human fashion and notice other instances of their intelligence. If you closely watch you will see what appears to be real reasoning in their manipulation of nails and staples which they hammer into posts with pieces of shaped stone after the manner of human beings in the stone age.

On an artificial island are four young chimpanzees, confined there by a narrow strip of water and their limited intelligence. Much amusement can be had in watching them play all sorts of pranks with one another and seeing their romps and antics with pieces of cloth tossed to them by delighted visitors.

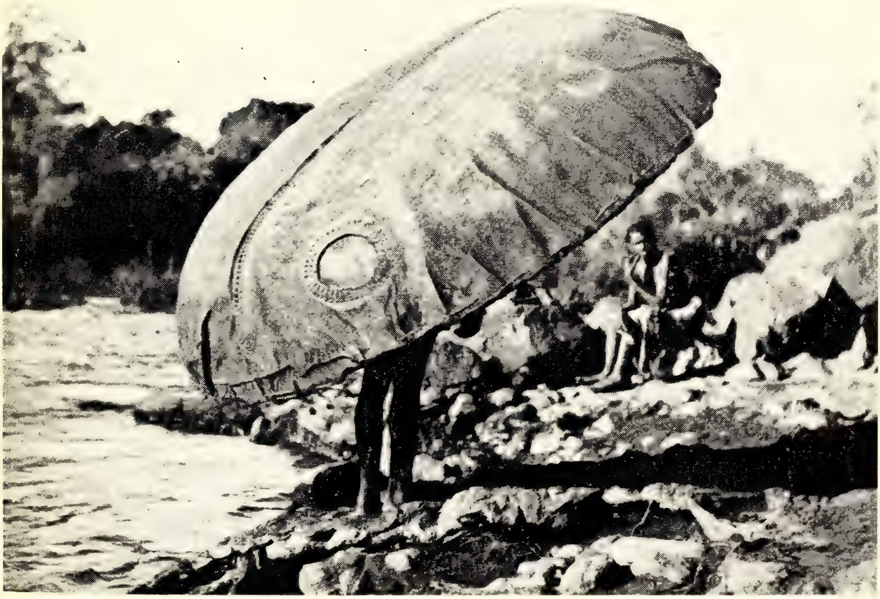
Observing these creatures kept within bounds merely because they do not know how to cross the seemingly impassable obstacle to freedom, the mind of the onlooker is perhaps turned to contemplation of the wonderful processes by which we human beings have progressed from even such beginnings as this to the building of great ocean liners, battleships and submarines.

There is much room for conjecture as to how primitive man first conceived the idea of a means of crossing water-ways. There may have been a flood, a chance voyage on a drifting log, or anything of that kind. Probably the dawn of the idea was a log; then there would have been a raft of drift-wood, then reeds or logs of light wood, or of bamboos, bound together with lianas. Even at the present day the Mannans, an aboriginal tribe in Travancore, cross the wide waters of the beautiful Periyar Lake by means of primitive rafts of the giant bamboo as shown in the accompanying photograph. After the raft idea there would have been the use of a single log followed quickly by the propelling and guidance of it with a stick or pole; and from these beginnings must have come the dug-out of various shapes and sizes still so widely used in many parts of the world; as the poet says, 'rivers then first the hollowed alders felt'.

Dug-outs have reached much perfection in many countries. In the Auckland museum is a dug-out eighty-two feet long by seven feet wide made in 1835 out of the bole of a gaint *totara* tree; it was propelled by a hundred rowers. In such a craft as this did the ancestors of the New Zealand Maories cross the wide uncharted seas of the Western Pacific to arrive at the beautiful islands which they have made their home for the past six hundred years. Off



A Coracle in use.



A Coracle in transit.

the West Coast of India the writer has felt complete confidence in the sea-worthiness of quite small dug-outs, even in tempestuous weather, miles from those palm-fringed shores.

In various parts of the world local requirements and available materials which guided invention to those primitive vessels have continued their use to the present day. In tropical forest lands dug-outs will probably be always used. There are bamboo rafts where those giant grasses grow; the birch bark of America is still used in wild places for the canoe, and more finished craft of that material are sold in up-to-date stores; the reed-raft is in use in Northern Australia; and the log-raft, the well known *catamaran* formed of three or four logs lashed together, is a familiar sight all along the eastern sea-board of Madras.

The coracle of Wales is no doubt of very ancient origin; as also is the basket boat used at the present time in Mesopotamia and India. Alexander the Great made use of these hide-covered circular boats during his invasion of the East; and the conquering armies of the East India Company which founded British Dominion in India were dependent on similar craft for conveyance of troops and supplies across the wide rivers of the Deccan and South India. Years ago, when on the march with a regiment, the writer had to arrange with the Civil Authority for a number of these useful and efficient vessels for the transport of men and baggage across the Kistna River. One boat could convey two loaded bullock carts as well as several soldiers; the bullocks were driven into the river and left to find their way across. On the Narbada river in Central India boats for such a purpose are of wood and more of the nature of barges, as the photograph shows.

Basket boats of bamboo framework covered with buffalo hide are in daily use in parts of South India for transport of passengers, carts, and goods of all kinds: and in many parts of India it is probable that the use of such primitive methods will never be discontinued.

Coracles, as the smaller of these boats are called by British sportsmen, are used by the wielder of the rod in South India; and very good and safe they are for the purpose, the native fishermen being exceedingly expert in their management. Fine fun it is to be hitched on to a big mahsir and race after him down the foam-tossed rapid to some large pool which may be quite a considerable distance down stream. Without a coracle one's fishing on some rivers would be greatly curtailed. In the photographs a coracle is seen in transit and in use: twenty rupees will buy a new one of the best bamboo and hide.

In out-of-the-way places the old and new combine as shown in the picture of the author's motor car being ferried over a wide river on a platform of strong bamboo matting laid on three dug-outs lashed together. A native bedstead placed across two small dug-outs makes an excellent duck-punt; and the humble hollowed log is indispensable to the sportsman in many Eastern lands, as also on the myriad waterways of South America.

Besides dug-outs, rafts, and such contrivances there are other primitive methods of crossing rivers in various parts of India.

Of such is the *sarnai*, the inflated hide of a buffalo with which, as seen in the picture, the hide of a calf is an auxiliary to support the arms and chest of the passenger as he kicks his way across the river. This contrivance is no doubt of great antiquity. There are other things of a similar kind such as gourds, bladders, earthenware vessels, and necessity being the mother of invention, on one occasion the writer, seated in a bath tub, pursued a bull bison across a river in Jeypur!

The making of various kinds of bridges no doubt followed, or accompanied, the progress of raft to dug-out; and from the tree across the stream primitive man advanced to the beautiful structures of cane and bamboo which are met with in Upper Burma. Here is a photograph of such an one in the Kachin country. To the use of these tigers soon become accustomed; and when that is known by the tracks it is not uncommon for Tom Puss to drop through a trap-door prepared in the centre of the bridge to be spiked on bamboo stakes firmly fixed in the ravine below: a cruel and inglorious end to the monarch of the primeval forests. But one can expect anything from people who make a practice of fattening up the friendly Chow dog—the family pet—for the family cooking-pot!

Mannans on the Peryar Lake.

A Sarnai.

THE RECENT PLACUNA PEARL FISHERY IN BARODA AND SOME NOTES ON THE WINDOW-PANE OYSTER.

BY

DR. S. T. MOSES.

In May 1938, the State department of Fisheries conducted a Pearl Fishery, in the Okhamandal area, more as a relief work which lasted for a little under three months. Prior to 1905, when the Fisheries Expert, Mr. James Hornell, visited Baroda for the first time, to advise the State on Fishery development, the very existence of the Window-pane oyster (*Placuna placenta*) and its pearl-bearing qualities were unknown both to the coastal residents and the State authorities. These oysters were found in bays on the North-eastern sea-board of the Okhamandal district, where the bottom is of soft mud, an agreeable habitat for the Mollusc which, therefore, flourished in extensive beds. There were also found inshore large areas, where dead shells were embedded in the muddy bottom, the result of innumerable generations of countless numbers of mature oysters, which had died where they lived. The dead window-pane oysters, unlike the true Pearl-oyster from which when dead, pearls cannot be retrieved, retain the pearls in situ, even while dead and buried in the mud. For a series of years, the beds of both live and dead oysters were leased out and fetched an average annual revenue of over Rs. 10,000, the maximum to which the rental soared being Rs. 25,300 in 1913-14. A series of transplanting experiments were also conducted, the beds in Balapur and Kiu yielding gratifying results. The value of pearls from live oysters being higher than those from the dead ones, the contractors paid more attention to live beds and the relaid banks, not that the dead beds were ignored. The Placuna pearls are small and are poorer in lustre than the pearls yielded by the true Pearl-oyster; being more used in medicine, particularly in the Far East, they have a low value, which of late has dwindled, and an uncertain market. The beds had, therefore, complete rest for over 7 years, if we omit a small fishery attempted for a month or so in 1935 by a lessee. The coastal population were suffering and so to afford them relief, one of my earliest activities, after starting the Department of Fisheries in Baroda, was to arrange a Pearl fishery. Thus a departmental fishery was organised this year and the dead oyster beds in the following bights in the Rann Bay from Poshetra point to the frontier separating Nawanagar from Baroda viz. 1 Nangsura, 2. Divdi, 3. Kurichli, 4. Nangara, 5. Beditad, 6. Jegania, 7. Kagiatad, 8. Doribid, 9. Katumba and 10. Sarihad, were fished (Vide Map). Fishing is done at low tides, particularly on the days of major spring tides when great areas of the shallow seas are exposed. The fisher—the work is done usually by men though a few women also join—with crude mocassins of rough hide shod on his feet—to prevent their damage by cuts from the sharp-edged shells—and cruder gloves fitted to his right hand, forces his way into the mire, with a stout stick, with which he plumbs the depth and feels his way. A gunny hangs by a rope slung across his shoulder and when the oysters are felt by the feet, he picks them up by hand and puts them into the bag. The collection goes on till the tide turns and makes it impossible to carry on any further. The oysters are then opened and the contents, mud with the pearls embedded, are carefully washed, strained and dried. The pearls are then picked up by being sifted. The beds most popular and so most frequently worked are Doribid and Kagiatad, Jegania and Nangara taking the next place among the prolific pearl-producing areas. In Doribid, it was found by actual counting, that as many as 893 oysters were sufficient to yield nearly one tola of pearls, while elsewhere a little over 2,000 were required for a tola of pearls. From measurements of the dead oysters it was seen that the sizes ranged from 8.6 cms. × 9 cms. to 12.8 cms. × 13.1 cms. and the oysters, judging from the varying thickness of the shells, belonged to many generations. The total depth of the deposit has not been ascertained but from trial pits and other examinations, the supply seems to be inexhaustible. In Doribid in pits roughly 2 feet square and about 2 feet deep, i.e. in a mass of glairy mud 8 cubic feet in content, between 12 to 17 dead oysters were taken. There were more below the 2 feet depth. In Jegania in similar pits 5 to 13 were found. The quantity of dead oysters present can well be imagined when it is remembered that the area exposed at low tide is 8 miles long along the coast line, and over ¾ of a mile broad in most places and in the bays nearer Nawanagar limits over 1½ miles.

Inspections of live oyster beds were made in Rann Bay as also at Balapur. In Rann Bay live oysters were found in good numbers from the lowtide level up to a depth of 9 feet at low water of the spring tide, and were completely absent in the exposed areas and very sparse in the deeper areas beyond the two-fathom line. As the Window-pane oyster selects a soft muddy bottom—it is found in association with another mud-lover the Brachiopod *Lingula* which is more abundant in Balapur than in Rann Bay. It is very difficult to work the live beds because apart from the softness of the mud, there is the violence of the tidal current to be reckoned with. Experienced local divers find the tidal rip to be strong and so the output is very little and not remunerative.

The action of currents has to be studied and understood, because without that knowledge, no cultural operations can be efficient. The generally accepted notion among the fishermen is that the oysters are wandering farther and farther away from the Baroda waters into the Jamnagar area, and hence they pleaded that work should be started early, as otherwise some 5 more years of inactivity will see the complete transference of the Window-pane oysters to the Jamnagar waters. The truth is that dead oysters are found closer inshore, and for living ones the fisher has to go into deeper waters and put in harder work, contending against tide, making use of boats, etc. In fact the work necessary is not mere wading and picking but actual diving, though this diving is child's play compared with the diving for *chanks* and Pearl-oysters in South India or Ceylon. There is also evidence that the Bay is in the process of silting up.

A knowledge of currents is essential in tracing from whence the spat repopulating the beds arrive, or whereto they pass from the present beds. Observations by a country boat following specially made wooden cubes fitted with tiny flags, set afloat in the oyster beds during the spatting season were suggested, but not tried because of the fear that such an attempt would be 'difficult and unsafe in the Gulf of Cutch and especially in Okha waters where underground reefs and boulders abound and currents are strong'. Drift bottles, i.e. bottles weighted with shot and containing cards to be returned by the finders, were liberated in 1919 and 1920. These drift bottle experiments conducted for 2 years led to the general conclusion that the current flows from North to South and follows the contour of the shore. It was inferred that currents from Balapur, Kiu and Gopi, where relaying experiments were done, pass eastwards and are caught by cross currents and so are deflected to the South and carried into the Rann Bay. Rann Bay has always been the source of supply for transplantation experiments.

From observations it was inferred that there are two spawning seasons of the dioecious Window-pane oyster, the first being the trimester October to December, and the other April to May. The first is more intensive, as generally confirmed by this year's dissections. In February the gonads were completely empty. In July there were signs of development in that the gonads were assuming a colour change towards orange and were thickening in size. Live oysters had their shells measured and the sizes ranged from 8 × 10.3 cms. to 13.4 × 14 cms. and a few were smaller 7.5 × 7.6 cms. to 8 × 8.2 cms. but as the history of these oysters, which are obviously of different broods, is not known, the measurements did not help in estimating the rate of growth. Growth rate is inferred from records made at the time of transplantation as follows:—'size: 4½ to 5 cms.: 2-3 months old, 10¼ to 11½ cms.: 18 months old'. The anatomy of the Window-pane oyster has been very succinctly described in Mr. Hornell's Report III, Part I, Marine Zoology of Okhamandal, 1909 and our dissections revealed no new feature nor any divergence from the type.

Pearls are located at the side of the visceral mass and also in the thin tissue of the free portion of the mantle. If, however, they are attached to the shell, as is frequently the case, they are of no use at all. Pearls are said to be found in the Window-pane oysters only after they reach the age of 3 years. That is they should have attained maturity and have spawned at least a couple of seasons. At one of our inspections, when 43 specimens were examined, there was not any, which had not at least 2 pearls. One oyster of the size 15 × 16.9 cms. yielded 4 pearls, another 10.8 × 12.4: 6 and another 15.2 × 16.7: 10 pearls. Of course all the pearls are seed pearls. While the difficulty in Bombay was to convince prospective bidders of the existence of pearl-bearing oysters, in Baroda waters it is not the lack of pearls or of oysters, dead or alive, but the problem of a good market for the pearls. Of the 43 specimens examined, all did not have the commensal peacrab (*Pinnotheres placunae*), but only 29 i.e. a great majority. In February I found the peacrabs carrying eggs.

A coincidence noted was that the bays in which the oysters yielded a comparatively richer crop of pearls were those patronised by fishermen as being more prolific of fish. There is however no danger of poaching for pearls, since apart from the gruelling nature of pearl fishery work, there is always the difficulty of the sale of pearls. Particularly do the fishermen find shoals of the beautiful wrasses which are very fat, *Platyglossus* spp., known in the vernacular as *Babat*. The Tetrodons (Vernacular: *Popcha, Khaku*) are also found but being inedible are rejected.

MEDICINAL AND POISONOUS PLANTS OF INDIA:

CAPPARIDS, MIGNONETTES, VIOLETS, ROCKROSES, BIXADS.

BY

J. F. CAIUS, S.J., F.L.S.

I

The CAPPARIDACEÆ are herbs or shrubs, rarely trees, distributed nearly equally over the tropical and subtropical regions of both hemispheres. They abound in Africa and India; some are found in Europe and Canada; the frutescent species are mostly American. There are 40 genera with about 450 species.

The herbaceous members are acrid, and their therapeutic properties are similar to those of the Crucifers. These same properties persist in the roots and the leaves of the arboraceous members, the bark of which is usually bitter and laxative.

Quercetin has been isolated from the flowers of *Capparis spinosa* Linn.

The medicinal and poisonous Capparids of the world belong to 10 genera:—BOSCIA (tropical and South Africa); CADABA (tropics of the Old World); CAPPARIS (warm regions); CLEOME (tropical and subtropical regions); COURBONIA (tropical Africa); CRATAEVA (tropical regions); EUADENIA (tropical Africa); GYNANDROPSIS (tropical and subtropical regions); MAERUA (tropical Africa and Asia); RITCHIEA (western tropical Africa).

The medicinal and poisonous Capparids of India belong to 6 genera:—CADABA, CAPPARIS, CLEOME, CRATAEVA, GYNANDROPSIS, MAERUA.

A. Herbs. Fruit capsular	
I. Stamens sessile on the disk. Petals imbricate in bud	CLEOME.
II. Stamens on the gynophore. Petals open in bud ...	GYNANDROPSIS.
B. Shrubs or trees. Fruit berried or capsular	
I. Calyx-tube lined by the disk, lobes valvate. Petals 4. Fruit moniliform	MAERUA.
II. Sepals 4, open in bud, disk hemispheric ...	CRATAEVA.
III. Sepals 4, biseriate, imbricate or 2 outer valvate	
a. Stamens 4-6, inserted high on the gynophore ...	CADABA.
b. Stamens 8-∞, inserted at the base of the gynophore	CAPPARIS.

CADABA.

The genus consists of 20 species, natives of the Palaeotropics.

Leaves ovate or oblong-obtuse	1. *C. farinosa.*
Leaves palmately 3-foliate	2. *C. trifoliata.*

1. **Cadaba farinosa** Forsk. (=*C. indica* Lam.) is very common in India. It is found in the Punjab, Baluchistan, Sind, the Rajputana Desert, Central India, Gujerat, Konkan, the Southern Mahratta Country, the dry districts of the Northern Circars, the

Deccan and the Carnatic from Vizagapatam southwards to the Madura District. It extends to Arabia and tropical Africa.

In Sind the leaves and roots are considered deobstruent and anthelmintic, and are prescribed in uterine obstructions. In Pudukota the root and leaves are used in decoction as an anthelmintic.

The plant is used as a general antidote in Arabia Felix. The fresh young branches are either masticated or taken in powder form.

In Senegal a decoction or an infusion is used in pulmonary affections, dysentery, fever and rheumatism.

Arabic : Asal, El-bejadd, Gorrah, Gorreh, Korrah, Saerah, Sserah—; *Bombay* : Habab—; *Canarese* : Chegaviche, Maragache, Maragade, Shegurti—; *Cutch* : Budkiyal, Janglimirchi, Karopinjero—; *Gujerati* : Khordu—; *Hausa* : Bagayi—; *Hindi* : Kodhab—; *Jodhpur* : Dabi—; *Katagum* : Anza—; *Madras* : Viludi—; *Malayalam* : Kattakatti—; *Porebunder* : Kalokatkiyo, Kimiyatunjadvung, Thaniung—; *Sind* : Kodhab—; *Tamil* : Vili—; *Telugu* : Adamorinika, Chavukuttiyanku, Chemudu, Chikonadi, Chimurudu, Polumokinika—; *Tigré* : Astan—; *Tigrinia* : Sernak, Tueblischnai—; *Yemen* : Asal, El-bejad, Korreh, Serah, Toreh—.

2. **Cadaba trifoliata** Wight and Arn. occurs in the Carnatic and in Ceylon.

In India the roots and leaves are used by Ayurvedic practitioners. They are considered purgative, emmenagogue, anthelmintic and antiphlogistic; they are said to be useful in the treatment of amenorrhoea, and dysmenorrhoea, indigestion of children, and painful joints. The leaves are much employed in the preparation of medicated oils.

Sanskrit : Balaya—; *Tamil* : Manudukkurundu, Viluti—; *Telugu* : Chekonadi—.

CAPPARIS.

The genus includes 200 species, natives of tropical and warm regions, except North America.

The genus exhibits stimulant, antiscorbutic and antispasmodic properties. The following species are used medicinally in Europe—*C. spinosa* Linn.—; in Southern Africa—*C. citrifolia* Lam., *C. Gueinzii* Sond., *C. tomentosa* Lam.—; in Brazil *C. Yco* Mart.—; in Peru and Bolivia—*C. coriacea* Linn.—.

A. Flowers axillary, solitary or in fascicles of 2-3
  I. Prostrate shrubs. Leaves orbicular or ovate-orbicular. Thorns usually hooked. Lower sepal not very saccate ... ... 1. *C. spinosa.*
  II. Erect shrub. Leaves elliptic-lanceolate. Thorns minute or absent ... ... 2. *C. heyneana.*
B. Flowers corymbose (sometimes racemose in *C. grandis*)
  I. Mature branches leafless ... ... 3. *C. decidua.*
  II. Mature branches leafy. Leaves olive-green, pubescent when young ... ... 4. *C. grandis.*
C. Flowers in shortly peduncled or sessile umbels. Woody climber ... ... 5. *C. sepiaria.*
D. Flowers supraaxillary in a vertical line on the branches.
  I. Leaves $1\frac{1}{2}$-3 by $\frac{1}{2}$-$1\frac{1}{2}$ in. ... ... 6. *C. zeylanica.*
  II. Leaves 4-8 by 2-$3\frac{1}{2}$ in. ... ... 7. *C. micracantha.*

1. **Capparis spinosa** Linn. occurs in the plains between the Indus and the Jhelum, the Salt Range, the low inner valleys of the Himalaya, Chamba, Kumaon, Nepal; it is fairly common in the Bombay Presidency, being chiefly found in Sind, the Konkan, the Deccan and the Western Ghats; it is also met with in Waziristan and Baluchistan, whence it extends to Afghanistan, the Mediterranean region, North Africa, and Australia.

The root bark is a favourite Yunani remedy. It is said to be aperient, tonic, expectorant, anthelmintic, emmenagogue and analgesic. It is commonly prescribed for rheumatism, paralysis, toothache, enlarged spleen, and tubercular glands. The juice of the plant, more especially the fruit, is used to kill worms in the ear.

In Baluchistan the juice of the fresh berries—or, if they are dry, the liquid obtained by adding a very little water—is poured into the ear as a cure for earache. In Ormara and Las Bela a jelly prepared from the fruits is considered to be a cure for rheumatism and for snake bite.

In the Punjab the dried bark of the root is considered diuretic. In Kangra, the macerated roots are applied to sores.

In Persia the root and root-bark are given for intermittent fever and rheumatism.

In Arabia the berries are given for toothache, and the bruised leaves applied to the head in cephalalgia.

In Europe the flower buds and fruits are considered aperient and diuretic. The young flower buds are the capers of the shops; they are esteemed antiscorbutic, stimulant, and aperient. The bark of the root passes for a diuretic. The leaves are bruised and used as poultices for gouty affections.

Afghanistan: Kabarra, Kabawa, Kabra—; *Arabic*: Amdryan, Azuf, Kabar, Kabbar, Kabur, Lassaf, Leysouf, Schok-el-homar, Uard-el-gebel—; *Baluchi*: Krap—; *Bettani*: Kamarkuniae—; *Bombay*: Kabar—; *Canarese*: Mullukattari—; *Catalan*: Tapara, Taparera—; *Diwana*: Pahinro—; *Dutch*: Kapperboom—; *Egypt*: Kabar, Lassaf, Shok-el-homar, Ward-el-gebel—; *English*: Caper Plant—; *French*: Caprier, Tapenier—; *German*: Kapernbaum—; *Greek*: Kapparis, Rimoniaria—; *Hamadan*: Risha kabar—; *Hebrew*: Ezov—; *Hindi*: Ber, Kabara, Kabra—; *Iraq*: Kabar—; *Italian*: Capparo, Cappero—; *Jaunsar*: Bauri, Kiari—; *Jhalawan*: Khafkhander, Khakandir—; *Kumaon*: Bussar, Ultakanta—; *Ladak*: Kabra—; *Las Bela*: Kirap, Krap, Pahinro, Panetero—; *Malta*: Caper-plant, Cappara, Capparo, Cappero—; *Northern Baluchistan*: Khawarg—; *Ormara*: Kirap, Krap—; *Persian*: Kabar, Kebir, Kurak—; *Portuguese*: Alcaparra—; *Punjab*: Bandar, Barar, Barari, Bassar, Bauri, Ber, Kabarra, Kabra, Kakri, Kander, Kaur, Keri, Kiari, Taker—; *Russian*: Kapersovyi kust—; *Sind*: Kalvari—; *Spanish*: Alcaparra, Alcaparro—; *Syria*: Kabar—; *Teheran*: Risha kavar—; *Telugu*: Kokilakshamu—; *Tibet*: Kabra—; *Turkish*: Kabarish—; *Urdu*: Kabar—; *Waziri*: Katmavae—; *Yemen*: Lasaf—.

var. *canescens* Coss. occurs in Baluchistan. The leaves are bitter; they are used by the Baluchis as a medicine for goats.

Baluchi: Khafkhandar, Krap—; *Brahui*: Karap, Khafkhandar—.

var. *parviflora* Boiss. is found in Baluchistan, where the plant, boiled in water, is applied as a poultice for boils.

Baluchi: Krap—; *Brahui*: Khafkhandar, Khalkandir—.

2. **Capparis heyneana** Wall. is found in the Western Ghats of South Konkan and North Kanara, spreading to the Tinnevelly District and Ceylon.

The leaves are used for rheumatic pains in the joints, and the flowers are made into a laxative drink.

Hindi: Chayruka—.

3. **Capparis decidua** Edgew. (= *C. aphylla* Roth.) is found in Sind, Baluchistan, Western Rajputana, Punjab, Central India, Gujerat, Deccan, and Tinnevelly. It extends to Socotra, Arabia, Egypt, and tropical Africa.

The bark and the fruit are Ayurvedic medicines of some repute. The whole plant is used by Yunani practitioners.

In the Punjab, the top shoots and young leaves are made into a powder and used as a blister; they are also applied to boils, eruptions and swellings, and used as an antidote to poison; they are prescribed in affections of the joints; when chewed, they are efficacious in relieving toothache.

The fresh young twigs (tips only) are crushed and soaked in water. The water is strained off. Sometimes this is done twice or thrice. The residuum is dried and allowed to solidify. A tiny piece of it is eaten with butter and gives relief from pain after a bruise or fall. Also makes a very strong plaster (Hotson).

Arabic: Hanbag, Margh, Sodab, Sodad, Tundub—; *Baluchistan*: Kaler, Kalir, Karar, Khirar—; *Berar*: Kari—; *Bombay*: Kari—; *Canarese*: Chippuri, Karira—; *Deccan*: Karyal—; *Egypt*: Hagbaq, Tundub—; *Gujerat*: Ker, Kera—; *Hindi*: Karel, Karer, Karu, Keril, Kurrel, Kurril, Lete, Satari—; *Jaisalmer*: Ban—; *Jodhpur*: Kair—; *Konkani*: Kiral—; *Marathi*: Karil, Ker, Kera, Nevati—; *North-Western Provinces*: Kair, Kari, Karil—; *Persian*: Bergesodab—; *Punjab*: Delha, Karel, Karia, Karil, Karis, Karril, Kerin, Kirra, Pinju, Tenti—; *Sanskrit*: Granthila, Gudhapatra, Kantaki, Karaka, Karira, Kataphala, Krakatha, Krakara, Krishashakha, Marubharuha, Mriduphala, Nishpatra, Nishpatrika, Shakapushpa, Shatakunta, Shonapushpa, Suhala, Tikshnakantaka, Tikshnasara, Ushnasundara, Vidahika, Vishvakpatra—; *Sind*: Dorakiram, Kirab, Kiral, Kirrur—; *Tamil*: Kulaladondai, Sengam, Sirakkali—; *Telugu*: Kariramu—; *Urdu*: Titali—; *Waziristan*: Karil, Kirra—.

4. **Capparis grandis** Linn. fil. is found in Mount Abu, Western Rajputana, Kanara, the Carnatic, the hill-forests of the Deccan, and on the eastern slopes of the Western Ghats from the Godaveri southwards.

An infusion of the bark and leaves is used internally for swellings and eruptions in Western Rajputana.

Bombay: Puchaonda, Ragota—; *Buldana*: Pacharan—; *Burma*: Hkawkwa—; *Canarese*: Revapi, Tarate, Totte, Tottulla—; *Deccan*: Pachaonda—; *Gujerati*: Dhuti—; *Konkani*: Ragot—; *Lambadi*: Raldero—; *Malayalam*: Waghutty—; *Marathi*: Kandel, Katarni, Kauntel, Pachenda, Puchunda, Ragot—; *Melghat*: Pacharan—; *Nimar*: Pachar—; *Porebunder*: Dhuti—; *Rajputana*: Antera—; *Tamil*: Nakkulinjan, Turattu, Vellaitturattu—; *Telugu*: Dridonda, Dudduppi, Guli, Nalluppi, Regutti—; *Yeotmal*: Pachunda—.

5. **Capparis sepiaria** Linn. is found in the dry parts of India and Ceylon. It extends to Malaya, Indo-China, Timor and Australia.

The plant possesses febrifugal properties. It is considered to be alterative and tonic; it has been found useful in skin diseases.

Bengal: Kaliakara, Kantagurkamai—; *Canarese*: Kadukattari—; *Gujerat*: Kantharo—; *Hindi*: Hiun, Kanthari—; *Marathi*: Kanthar, Kantharyel—; *Merwara*: Katan, Kataran—; *Porebunder*: Kalokantharo, Kantharo—; *Punjab*: Hiungarna, Hius—; *Sanskrit*: Ahimsra, Amlaphala, Dupravesha, Durdharsha, Guchchagulmika, Gridhranakhi, Hinsra, Jali, Kakadani, Kakatinduka, Kantha, Kanthari, Kantharika, Kanya, Kapalakulika, Krishnashriphalika, Kruragandha, Krurakarma, Tikshnagandha, Tikshnakantaka, Vakrakantaki, Vayastinduka—; *Tamil*: Karindu, Karunjurai, Kattukkattiri, Kokkimullu, Sirukkattiri—; *Telugu*: Nallapuyyi, Nallavuppi, Nalluppi, Puyyi, Uppi—; *Uriya*: Hulubhi, Kantikapali, Koli, Kontoko, Nibido, Otaibe, Solorakoli—.

6. **Capparis zeylanica** Linn. (= *C. horrida* Linn. fil.) is to be found throughout the greater part of India; it extends to Java and the Philippine Islands.

Ayurvedists use the root-bark as a bitter and a cholagogue.

The root-bark is sedative, stomachic, and antihidrotic.

In Northern India, the leaves are used as a counter-irritant and as a cataplasm in boils, swellings and piles.

In Chota Nagpur, the bark, along with native spirit, is given in cholera. The Mundas use the thorns to prick the pustules of small pox. The root, well ground, and mixed with those of *Cassia occidentalis* and *Mimusops elengi*, is rubbed on the body in dropsy; also, even alone, on aching bodies, legs, or feet.

Ajmere: Gitoran—; *Bengal*: Bagnai, Kalokera—; *Bombay*: Anti, Taranti, Tarti, Wag, Wagatti—; *Burma*: Nahmanitanget, Nahmanitanlyet, Nwamanithanlyet—; *Canarese*: Mullukattari, Totte, Tottulla—; *Ceylon*: Kattoddi, Kilaohedi, Vennachi—; *Deccan*: Ardanda—; *Dehra Dun*: Hins, His, Kalhins, Kalhis, Khalis—; *Gond*: Katerni—; *Hindi*: Ardanda, Jhiri—; *Ilocano*: Talactac—; *Kharwari*: Bagnahim—; *Kolami*: Gaterna—; *Konkani*: Govindphal, Wageti—; *Kumaon*: Bipuwakanta, Ultakanta—; *Marathi*: Govindi, Pachwa—; *Matheran*: Taranti, Tarti—; *Monghyr*: Bagnai—; *Mundari*: Gaterna, Kularama, Marijanum, Ramakula—; *Oudh*: Karrallura—; *Punjab*: His, Hiungarna, Karvila—; *Sanskrit*: Govindi, Granthila, Kantakalata, Karambha, Katukandari, Kinkani, Krishangi, Tapasapriya, Vartala, Vyaghraghanti, Vyaghrapada, Vyagranakhi—; *Santali*: Buru asaria—; *Sind*: Ardanda—; *Sinhalese*: Welangiriya—; *Tagalog*: Dauag—; *Tamil*: Adondai, Igudi, Indu, Kaguturatti, Kottotti, Migupalattam, Tondai, Tulambikkiri, Viyanicham—; *Telugu*: Adonda, Aridonda, Chittigara, Doddi, Palaki—; *Uriya*: Asadua, Govindi, Lobhyotai, Osaro, Oserwa—; *Visayan*: Laguino—.

7. **Capparis micracantha** DC. occurs on seashores and spots in Pegu, Tenasserim, the north of the Malay Peninsula, extending to Siam, Cambodia, Java, Timor and the Philippine Islands.

The roots and the wood are used medicinally in Cambodia. The roots are considered diuretic. The wood is given for bronchitis and for ulceration of the mucous membrane of the nose.

Cambodia: Kanhchoeu bai dak—; *Tagalog*: Dáuag, Halugábat, Mararáyatcáhoy—; *Visayan*: Alagúng-ung, Salimómo—.

CLEOME.

The genus consists of 70 species, inhabitants of tropical and subtropical regions.

The leaves are stimulant; the roots stimulant, antiscorbutic, and anthelmintic; the seeds rubefacient, vesicant, anthelmintic, and carminative.

The following are used medicinally:—in Indo-China—*C. Chelidonii* Linn., *C. viscosa* Linn.—; in the Philippine Islands—*C. viscosa* Linn.—; in North and Central America—*C. gigantea* Linn., *C. graveolens* Rafin., *C. heptaphylla* Linn., *C. serrata* Jacq., *C. viscosa* Linn.—; in the Gold Coast—*C. ciliata* Schum. & Thonn.—; in La Reunion—*C. viscosa* Linn.—; in Guiana—*C. frutescens* Aubl.—.

A. Leaves simple	
Stamens 6 or less	
Leaves oblong-lanceolate, penni-nerved; bracts petiolate	1. *C. monophylla.*
B. Leaves compound	
I. Stamens 6. Capsules sessile or subsessile	
Leaflets linear-oblong to obovate. Stem and leaves not asperous	2. *C. brachycarpa.*
II. Stamens indefinite	
a. Flowers yellow. Capsule glandular pubescent ...	3. *C. viscosa.*
b. Flowers purple or pink. Capsule glabrous, striate	4. *C. felina.*
c. Flowers rosy. Capsule smooth	6. *C. Chelidonii.*
d. Leaves 7-foliolate	5. *C. heptaphylla.*

1. **Cleome monophylla** Linn. is found in fields and waste places from Bihar and Orissa to Gujerat, the Deccan, the Konkan, the Southern Maratha country, and Ceylon. It also occurs in tropical Africa.

The pounded root is put on the lips by the Santals to restore consciousness when in a faint.

Kolami: Chamani—; *Mundari*: Carmani ara, Carmari ara—; *Sadani*: Hurhuriasag—; *Santali*: Harhara, Hurhura, Kedar Jhawar—.

2. **Cleome brachycarpa** Vahl is found in Sind, Baluchistan, the West Rajputana Desert and the Punjab Plain. It extends westwards to Arabia, Abyssinia and North Africa.

Mohammedan practitioners use the plant in the treatment of scabies, rheumatism and inflammations; they consider the leaves beneficial in leucoderma.

In Ormara the plant is said to be a useful medicine for persons suffering from heat. The Baluchis crush the leaves in oil and rub the paste on the arms and legs as an embrocation for high fever.

In Jodhpur and Jaisalmer the plant is used to cure worms in camels' noses.

The strongly aromatic leaves are often sold in the market of Aden. They are put between clothes in order to protect them against insects.

Arabic: Berberem, Chosam, Daf—; *Baluchi*: Miskok—; *Brahui*: Pawal—; *Egypt*: Berberan—; *Jhalawan*: Panwar—; *Ormara*: Shapako, Shawang—; *Rajputana*: Navli, Nodi—; *Sind*: Kasturi—; *Urdu*: Panwar—.

3. **Cleome viscosa** Linn. is found throughout the tropics of the world.

Both Hindu and Mohammedan practitioners credit this weed with great therapeutic value as an anthelmintic and carminative. The juice of the leaves, poured into the ears, is useful in deafness.

The juice of the leaves mixed with oil is a popular Indian remedy for purulent discharges from the ear.

The juice of the leaves is poured into the ear to relieve earache, and the bruised leaves are applied to the skin as a counter-irritant.

The seeds are used as anthelmintic and carminative; they also are given occasionally in fevers and diarrhoea.

In Indo-China the roots are considered to be stimulant and antiscorbutic; the whole plant, bruised, is used for counter-irritation and blistering.

In La Reunion the plant is said to be astringent and anti-spasmodic.

The leaves are given by the aboriginals of Australia to relieve headache.

In the United States, the roots are said to be used as a vermifuge.

In Ceylon the roots and the seeds are considered to be cardiac stimulants, and they are given internally in cases of snake bite (Roberts). But Mhaskar and Caius have shown experimentally that both the roots and the seeds are useless in the antidotal and symptomatic treatment of snake bite.

'The seeds of this plant are said to possess anthelmintic and rubefacient properties. Mohideen Sheriff recommends the pure dried seeds as substitute for santonin. The dose recommended is half to one drachm for adults and half the quantity to children to be given twice a day for two days and followed on the third day by a dose of castor oil. I tried the drug as per directions given above in an adult and in a child whose motions contained large number of round-worm ova, but the result was negative in both the patients' (Koman).

Arabic : Bantakalan, Oddar—; *Bengal* : Hurhuria—; *Biru* : Cirlinggid—; *Bombay* : Hurhuria, Kanphuti, Pivalatilavana—; *Canarese* : Huchasasavi, Nayibela—; *Deccan* : Choriajuwan, Churaiyajwani, Janglihulvul—; *English* : Sticky Cleome—; *French* : Brède puante, Herbe puante—; *Gangpur* : Cirliggid—; *Guam* : Mongos paloma—; *Gujerat* : Talvani, Tilwan, Tinmani—; *Hausa* : Namijan gasaya—; *Hindi* : Boogra, Hulhul, Hurhur, Hurhureh, Jangliharrar, Kamphutia—; *Indo-China* : Man man trang, Sa phac ron tien—; *Kolami* : Chamani—; *Malay* : Kutepeng—; *Malayalam* : Ariavila, Katkudagu—; *Marathi* : Harhuria, Kanphodi, Kanphuti, Pivalatilavana—; *Mundari* : Marang carmaniara, Marang carmari—; *Porebunder* : Pilitalvani—; *Portuguese* : Bredo mamma—; *Punjab* : Bugra, Hulhul—; *Sanskrit* : Adityabhakta, Arkabhakta, Arkakanta, Arikahita, Barbara, Bhaskareshta, Brahmasuvarchala, Karnasphota, Kukavaiminta, Kukavumitie, Mandukaparni, Manduki, Martandavallabha, Raviprita, Ravishta, Sauri, Satyanamni, Shunakabarbara, Surasambhava, Suryalata, Suryavarta, Suvarchala, Suteja, Svanabarbara, Tilparni, Varada, Vikranta—; *Santali* : Harhara—; *Sind* : Kattori—; *Sinhalese* : Ranmanissa, Walaba—; *Tagalog* : Apoyapoyan, Balabalanoyan, Silisian, Silisilihan—; *Tamil* : Nayikudagu, Nayivelai—; *Telugu* : Kukhavavulu, Kukhavominta—; *Urdu* : Hulhul—; *Visayan* : Hulayasangayan—.

4. **Cleome felina** Linn. fil. occurs in the Southern Maratha Country, the Northern Circars and the Deccan districts of the Madras Presidency.

The plant is reputed antiscorbutic.

The seeds are vesicant; they are given internally as a vermifuge.

The plant mixed with milk is applied externally to raise blisters.

Malayalam : Ariavila—.

5. **Cleome heptaphylla** Linn. is an American plant grown in Indian gardens.

It is used as a stomachic and as a vulnerary.

6. **Cleome Chelidonii** Linn. fil. is found in the Northern Circars and in most places throughout the Bombay Pesidency. It is also found in Indo-China and Java.

In Indo-China the roots are considered to be vermifuge. An infusion of the plant is commonly used in gingivitis and in the treatment of skin diseases.

Indo-China : Man man— ; *Porebunder* : Ubhitalvani— ; *Telugu* : Kar wominta—.

CRATAEVA.

This genus consists of 10 tropical species.

C. religiosa Forst. is used medicinally in Indo-China and the Philippine Islands, *C. tapia* Linn. in Brazil and Guiana, *C. Greveana* Baill. in Madagascar.

Crataeva nurvala Ham. (=*C. religiosa* Hook. fil. and Th.—non Forst.—) is found almost everywhere all over India and Burma, either wild or cultivated. Although commonly met with along streams, it may also be found in the dry deep boulder formations of the sub-Himalayan tract. A native of Malabar and Canara.

Its properties are described in Sanskrit and in Persian works. It is said to promote the appetite, increase the secretion of the bile, act as a laxative, and remove disorders of the urinary organs. In calculous affections it is used in a great variety of forms; thus a simple decoction of the bark may be given with the addition of treacle.

The bark is demulcent, antipyretic, sedative, alterative, and tonic; and the fresh leaves and root-bark are rubefacient.

The bark is a Pondicherry remedy for amenorrhoea. Boiled in oil it is considered good for rheumatism.

The bark is useful in some cases of urinary complaints and fever, and in some mild forms of skin diseases in which sarsaparilla is generally resorted to. It also relieves vomiting and other symptoms of gastric irritation. The fresh leaves and root-bark, particularly the former, are very efficacious in all the affections in which mustard poultice is indicated.

Bruised well with a little vinegar, lime-juice or hot water and applied to the skin in the form of a poultice or paste, the fresh leaves act as a rubefacient and vesicant. The bark and leaf pounded and tied in a cloth are used as a fomentation for rheumatism.

In Ceylon the leaves are used for gouty swellings. In Bombay they are a remedy for swelling of the feet, and a burning sensation in the soles of the feet. In the Konkan the juice is given in rheumatism. In caries of the bones of the nose, the leaf is smoked and the smoke exhaled through the nose. In China the leaves are used in drunkenness; an extract is given for diarrhoea.

A couple of buds pounded with salt are taken before meals to promote the appetite. In indigestion they must be given after meals.

In Ceylon the bruised roots, leaves and seeds are applied topically to snake bites and scorpion stings. But Caius and Mhaskar have shown experimentally that they are useless as an antidotal and symptomatic treatment.

Bengal: Barun, Tikoshak, Tiktoshak, Varuna—; *Bombay*: Bhatavarna, Hadavarna, Kawan, Kumla, Vayavarna, Waruna—; *Burma*: Kadat, Kadet, Katat—; *Canarese*: Bilpatri, Bitusi, Hoddelenage, Mavilinga, Narave, Neravambele, Neravele, Nervala, Nirvala, Tudemadirenge, Vitusi—; *Central Provinces*: Bel, Bela—; *Chinese*: Pa Yeh—; *Coorg*: Nerajane, Nerujani, Nirajani, Vittasi, Vitusi—; *English*: Holy Garlick Pear—; *French*: Tapier—; *Gujerati*: Varno, Vayavarno—; *Hansot*: Kagdakeri—; *Hindi*: Barna, Barua, Barun, Bila, Bilasi, Biliana, Brarna, Varuna, Varvunna—; *Konkani*: Nervol—; *Lao*: Mai fuk koom—; *Lepcha*: Purbong—; *Malay*: Cadat—; *Malayalam*: Kili, Niravila, Nirumaliyan, Varana, Vitusi—; *Marathi*: Haravarna, Karvan, Kumla, Nirvala, Ramola, Varun, Vayavarna—; *Mechi*: Bunboronda, Tailaslu—; *Punjab*: Barna, Barnahi—; *Rajputana*: Barna, Barnahi—; *Saharanpur*: Barna, Bilarsi, Brarna—; *Sanskrit*: Ajapa, Ashmarygna, Asmarighna, Barhapushpa, Kumara, Kumaraka, Mahakapittha, Marutapaha, Pasunadha, Sadhuvriksha, Setuka, Setuvriksha, Shikhimandala, Shvetadru, Shvetadruma, Shvetavriksha, Tamala, Tiktashaka, Urumana, Varana, Varuna, Vasaha—; *Sinhalese*: Lunuwarana—; *Tamil*: Adicharanam, Adimalam, Anjali, Inaivilai, Kattumavilangai, Kuvilam, Maluram, Maralingam, Mavilangai, Miguttiyal, Narvala, Nilluvam, Nirumaliyam, Periamavilangai, Shuppigam, Shuvedan, Sinnamavilingam, Tiriburamerittan, Varanam, Villuvam—; *Telugu*: Bilvaram, Chinnavulumidi, Magalingam, Maredu, Peddamagalingam, Peddavulimidi, Tellavulimidi, Ulimidi, Urumatti, Urumudu, Usiki, Uskia—; *Urdu*: Barna—; *Uriya*: Barun, Boryno, Varuna—.

GYNANDROPSIS.

This genus includes 15 species spread over the tropical and subtropical regions of the world.

Gynandropsis gynandra Merrill (= *G. pentaphylla*) is used medicinally wherever it is found growing. It is a common weed in all tropical countries, and is abundant throughout the warmer parts of India.

It has long been known as a domestic remedy by the Hindus. The seeds, as well as the leaves, are administered in decoction in convulsive affections and typhus fever, to the quantity of half a teacup daily.

A decoction of the root is said to be a mild febrifuge.

The leaves are applied externally to boils to prevent the formation of pus. The bruised leaves are rubefacient and vesicant, producing a very copious exudation, affording in many cases the relief obtained from a blister without its inconveniences. The expressed juice is a popular remedy, in high repute as a local application in otalgia, both amongst the natives of India and the settlers in the West Indies, where the plant is also indigenous.

In Jodhpur and Jaisalmer the leaves are used against rheumatism; the green leaves applied to the skin and tied down form a good blister.

In Arabia the juice of the fresh leaves is made into an ointment with sesame oil, and used for prurigo.

In Yoruba the natives use the roasted leaves as a cure for earache; the jucie also is mixed with palm-kernel oil and squeezed into the ear.

In Gold Coast the juice of the leaves is commonly used for curing earache, and sometimes for curing headache. As it causes pain when applied freely to the eye or the ear it should be used with care.

The Shangaans of South Africa apply the pounded leaf as a counter-irritant in rheumatism, neuralgia, headache, and a stiff neck, taking care to withdraw the application before it produces a blister.

The seeds are anthelmintic and rubefacient, and are employed internally for the expulsion of round worms, and, externally as a counter-irritant. They are used as a substitute for mustard, and yield a good oil.

In Lakhimpur (Assam), a paste of the seeds is applied locally in headache.

In the Rajputana Desert the seeds infused in boiling water are used as a cure for coughs; bruised, they are applied as a poultice to sores that have maggots in them (Blatter). They are given to horses for stomach-ache.

The plant is used as a sudorific in Pondicherry and in the Nilgiris.

In Indo-China the plant is used as an antiscorbutic. In La Reunion it is mostly used as a diaphoretic, and as an emollient in the form of poultice.

A reputed cure for cobra bite in Ceylon; the bruised roots, leaves, and seeds are applied to the wounds (Roberts).

The plant is not an antidote to snake and scorpion venom; and it is useless as an external application in the treatment of snake bite or scorpion sting (Caius and Mhaskar).

Arabic: Gheifakan—; *Ashanti*: Tete—; *Awuna*: Sorbui—; *Bengal*: Ansarisha, Arkahuli, Hulhul, Hurhur, Hurhuria, Kanala, Kanalla, Karaila, Sadahurhuria—; *Bombay*: Mabli, Tilavana—; *Ceylon*: Tayirvalai—; *Chinese*: Pai Hua Ts'ai—; *Deccan*: Halhal—; *Egypt*: Abu-qarn, Arareg, Tamalika—; *Ewe*: Sorlwi—; *Ga*: Kete, Tete—; *Gujerati*: Adiyakarhan, Satitalvani, Tanmani—; *Hausa*: Gasaya—; *Hindi*: Churota, Hulhul, Hurhur, Karaila, Lalhulhul, Safedhulhul—; *Indo-China*: Man ma tia—; *Kano*: Gasaya—; *Kolami*: Chamani—; *Krobo*: Tete—; *La Reunion*: Pissat de chien—; *Loanda*: Mozambue, Mozembue—; *Malay*: Maman antu, Maman putih—; *Malayalam*: Karavela, Taivela, Vela—; *Marathi*: Kanphodi, Mabli, Motitilavan, Pandharitilavan, Tilavana—; *Mundari*: Carman, Ciarmari, Marangcarmani, Marangcarmari, Tundicarmani—; *New Caledonia*: Oua meti hakon—; *North-Western Provinces*: Kathalparhar—; *Philippines*: Cincocinco, Silisihan—; *Porebunder*: Dholitalvani, Gandharitalvani, Satitalvani—; *Punjab*: Ghanduli, Hulhulsafed—; *Rajputana Desert*: Bagra, Pagra—; *Sanskrit*: Ajagandha, Arkapushpika, Avigandha, Barbaragandha, Bastagandha, Bodhayika, Bramhagrabha, Brahmi, Choraka, Hulhul, Kabari, Karnaspota, Kjarapushpa, Putimayurika, Sugandhika, Surjavarta, Tilaparni, Tungi, Ugragandha—; *Santal*: Setakataarak—; *Sind*: Kinro—; *Sinhalese*: Suriyavarta, Vela—; *Sokoto*: Yarungawa—; *Tagalog*: Apoyapayan, Balabalanoyan—; *Tamil*: Kadugu, Nayvelai, Velai—; *Telugu*: Vaminta, Velakura—; *Twi*: Tete—; *Visayan*: Hulaya—; *Yoruba*: Ekuya—.

MAERUA.

This genus includes 40 species, natives of tropical Africa and Asia.

M. angolensis DC. is said to be toxic, but is nevertheless used medicinally in Somaliland and Abyssinia, where *M. Denhardtiorum* Gilg. is similarly employed.

Maerua arenaria Hook. fil. and Th. is found in the Punjab, Sind, Gujarat, the Deccan, Central and South India, and Ceylon.

The root is used as an alterative, tonic, and stimulant.

Cutch: Dhoropinjero, Katkiyal—; *Gujerat*: Vika—; *Porebunder*: Dholokatkiyo, Dudhiyohemkand, Hemkand—; *Tamil*: Bhumichakkarai, Mulmurandai—; *Telugu*: Bhuchakramu, Makamettanitige, Menikatige, Morinika, Pattatige, Pattutige, Puttatige—.

II

The RESEDACEÆ are herbs, rarely shrubs, grouped into 6 genera including about 70 species. They grow in southern Europe, northern Africa, Syria, Asia Minor, and Persia; some reach the Indian frontier; a few inhabit central and northern Europe; three species belong to the Cape of Good Hope.

Medicinal Mignonettes belong to three genera: OCHRADENUS (southern Mediterranean); OLIGOMERIS (Africa, India, south-western North America); RESEDA (Mediterranean region, Europe).

1. Petals 4-7, lobed; ovary syncarpous ... RESEDA.
2. Petals 2; ovary syncarpous ... ... OLIGOMERIS.
3. Petals 0; ovary syncarpous; fruit a berry ... OCHRADENUS.

OCHRADENUS.

The genus consists of 5 species spreading from the Mediterranean to Sind.

Ochradenus baccatus Del. occurs in Sind and Baluchistan; extending to Persia, Arabia, Syria, Egypt, Nubia and Abyssinia.

In Baluchistan the twigs, leaves, and flowers are fried, ground to a powder, mixed with a little neshar and applied dry to wounds and sores to kill maggots, etc. (Hotson).

Arabic: Bliha, Gord, Gurdy, Gurssi, Gurzi, Qurdhah, Wuebeh—; *Baluchistan*: Kalirram, Kirmkush—; *Egypt*: Gurdy—.

OLIGOMERIS.

This genus includes 5 species distributed over Africa, Western Asia, India, and North America.

Oligomeris subulata (Del.) Boiss. is found in Sind, Baluchistan and the Punjab; it extends to Afghanistan, Persia, Arabia, the Mediterranean, and West North America.

In Kalat the plant is pounded, and the juice thus extracted is used by women to put on to their breasts to keep them soft.

Egypt : Deneban, Dhenebun—; *Kalat* : Shataki—.

RESEDA.

This genus numbers 55 species inhabiting the Mediterranean region, Europe, and Western Asia.

The root is considered sedative, aperient, diaphoretic, and diuretic; the seeds are used as a resolvent.

The following are used medicinally: in Europe—*R. alba* Linn., *R. glauca* Linn., *R. lutea* Linn., *R. luteola* Linn., *R. odorata* Linn., *R. phyteuma* Linn.—; in North America—*R. alba* Linn., *R. luteola* Linn., *R. odorata* Linn.—.

Reseda odorata Linn. is widely cultivated in Indian gardens.

In Spain the acrid root is used as a laxative, diaphoretic, and diuretic; the seeds are applied externally as a resolvent.

Arabic : Khuzam—; *Catalan* : Mardugi, Marduixi—; *Dutch* : Reseda—; *Egypt* : Tamr-el-hina frengi—; *English* : Mignonette—; *French* : Herbe d'amour, Mignonnette, Réséda, Réséda odorant—; *German* : Gartenreseda, Reseda—; *Roumanian* : Roseta—; *Russian* : Reseda—; *Spanish* : Miñoneta, Reseda, Reseda de olor, Resedal—.

III

The Violaceæ are herbs or shrubs, natives of warm and temperate regions. The herbaceous species principally inhabit the northern hemisphere; they are rare in the temperate regions of the southern hemisphere and in the tropics; the woody species are chiefly natives of equatorial America; many species inhabit the intertropical region of both worlds, and especially of America. The family includes 21 genera with about 450 species.

The members of this Order are used for their sedative, diaphoretic, diuretic, emetic, purgative, and expectorant properties.

Among the products isolated from them may be mentioned :—(1) *essential oils*; (2) *glucosides*—iridin, violaquercitrin, violutoside—; (3) *a carbohydrate*—inulin—; (4) *an ester*—methyl salicylate—; (5) *a mustard oil*—phenylethyl—; and (6) *colouring matters*—luteolin, quercetin.

The medicinal and poisonous Violets of the world belong to 5 genera :—Alsodeia (tropical and subtropical regions); Anchietea (tropical South America); Ionidium (tropical and subtropical regions); Sauvagesia (tropics; Brazil); Viola (cosmopolitan).

The medicinal and poisonous violets of India belong to 3 genera :—Alsodeia, Ionidium, Viola.

I. Corolla irregular. Lower petal dissimilar. Staminodes absent. Capsule loculicidal
  1. Sepals produced at the base ... ... Viola.
  2. Sepals not produced at the base ... ... Ionidium.
II. Corolla regular. Staminodes absent. Fruit a berry or loculicidal capsule ... ... Alsodeia.

ALSODEIA.

The genus includes 80 tropical and subtropical species.

Alsodeia echinocarpa Korth. is common in woods from Singapore to Tringganu. It extends to Southern Siam, Laos, Cochin-China, Borneo, and Sumatra.

The Malays use the seeds as a purgative.

A decoction of the leaves is used in Annam in cases of myiasis of the nostrils in ruminants. The drug is administered per os. The same decoction, but in smaller doses, is given to pregnant women to procure abortion.

Malay: Aho lumut, Jangut baong, Jenta-jenta, Kayu rembut, Lalada, Lelada, Medang gombot, Sebilik, Segumpa betina—; *Penang*: Ardani—.

IONIDIUM.

The genus consists of 50 tropical and subtropical species.

The root is diaphoretic, diuretic, and in large doses emetic and cathartic.

The following species are used medicinally in China—*I. heterophyllum* Vent.—; in South America—*I. brevicaule* Mart., *I. circaeoides* H. B. & K., *I. glutinosum* Vent., *I. Ipecacuanha* Vent., *I. oppositifolium* Roem. & Schult., *I. Poaya* St. Hil., *I. polygalaefolium* Vent., *I strictum* Vent—.

Ionidium enneaspermum Vent. (=*I. suffruticosum* Ging.) is found in Bundelkhand, Agra, Bengal, almost throughout the Madras Presidency, Gujarat, Khandesh, the Carnatic, and Ceylon. It is common throughout tropical Asia, Africa and Australia.

The native physicians regard the plant as a tonic and diuretic, and prepare a confection of the whole herb.

The Santals employ the root in bowel complaints of children.

The leaves and tender stalks are demulcent, and are used in decoction and electuary; they are also employed in conjunction with some mild oil in preparing a cooling liniment for the head.

The plant is used in Southern India as a demulcent in gonorrhoea; and its demulcent properties are known in New South Wales, where the plant is common.

Arabic: Ssibbah—; *Bengal*: Nunbora—; *Bombay*: Ratanpuras—; *Deccan*: Ratanpuras—; *Hindi*: Ratanpurus—; *Malayalam*: Orelatamara—; *Marathi*: Ratanpuras—; *Naguri*: Pirikantara—; *Sanskrit*: Amburuha, Atichara, Avyatha, Charati, Chariti, Lakshmishreshta, Padma, Padmacharini, Padmavati, Padmavha, Pushkaranadi, Pushkarini, Ramya, Sarade, Sthalapadmini, Sthalaruha, Sugandhamula, Supushkara—; *Santal*: Birsurajmukhi, Tandisol—; *Tamil*: Orilaitamarai—; *Telugu*: Nilakobari, Purusharatnam, Suriyakanti—.

VIOLA.

The genus includes some 300 species distributed broadly in temperate regions, chiefly of the northern hemisphere.

The root is slightly emetic; the leaves are considered emollient and laxative; the flowers are used as an emollient, diaphoretic, antispasmodic, and stomachic.

The following species are used medicinally :—in Europe—*V. alba* Bess., *V. alpina* Jacq., *V. arenaria* DC., *V. calcarata* Linn., *V. campestris* Bieb., *V. canina* Linn., *V. cenisia* Linn., *V. collina* Bess., *V. biflora* Linn., *V. hirta* Linn., *V. mirabilis* Linn., *V. odorata* Linn., *V. palustris* Linn., *V. pedata* Linn., *V. pinnata* Linn., *V. sciaphila* Koch., *V. sepincola* Jord., *V. sylvestris* Lam., *V. tricolor* Linn., *V. uliginosa* Bess.—; in China—*V. Patrinii* DC.—; in Indo-China—*V. diffusa* Ging, *V. japonica* Lang., *V. mirabilis* Linn., *V. Patrinii* DC., *V. pinnata* Linn., *V. sylvestris* Lam., *V. vaginata* Max., *V. verecunda* A. Gray.—; in North America—*V. canadensis* Linn., *V. canina* Linn., *V. cucullata* Ait., *V. lanceolata* Linn., *V. palmata* Linn., *V. pedata* Linn., *V. pubescens* Ait., *V. scabriuscula* Schwein—; in Colombia : *V. odorata* Linn., *V. tricolor* Linn.—; in Madeira : *V. maderensis* Prim.—.

The toxic glucoside *iridin* has been found in *V. canina, V. odorata, V. sylvestris,* and *V. tricolor.*

A. Stigma obliquely 2-lobed, not beaked; lobes short, spreading	7. *V. biflora.*
B. Stigma terminal, truncate, dilated, depressed, orbicular or lobed	
1. Flowers lilac or pale blue	5. *V. Patrinii.*
2. Flowers pale purple	4. *V. diffusa.*
C. Stigma very oblique or quite lateral, often minute and perforated	
1. Flowers lilac or pale blue	1. *V. serpens.*
2. Flowers bluish purple or white, more or less scented	2. *V. odorata.*
3. Petals lilac, the lower with a few parallel simple veins, not reaching the margin	8. *V. sylvestris.*
4. Flowers small, white with a violet blotch on the uppermost petal	3. *V. cinerea.*
5. Flowers large, usually about 3 colours represented.	6. *V. tricolor.*

1. **Viola serpens** Wall. is found in hilly districts throughout India, Ceylon, Burma, and the Malay Peninsula. It extends to Java, Sumatra and China.

This species yields *Banafsha* of the bazaars, and is considered to have medicinal properties similar to those of *V. odorata.* In the Punjab, a medicinal oil, called *raughan-i-banafsha,* is prepared from it.

Hindi : Banafsha, Thungtu—; *Kumaon* : Thungtu—; *Punjab* : Banafsha—; *Waziri* : Khojakai—.

2. **Viola odorata** Linn. occurs in Kashmir at 5,000-6,000 feet; it is planted in most of the hill-stations. It is distributed to Northern and Western Asia, North Africa, and Europe.

A long account of its properties will be found in most Arabic and Persian works on Materia Medica; it is generally considered cold and moist, and is especially valued as a diuretic and expectorant, and as a purgative in bilious affections. The diseases in which it is recommended are very numerous; they are generally those in which a cooling treatment is thought to be indicated by the hakims.

Violets were used by the Athenians to moderate anger, to procure sleep and to comfort and strengthen the heart.

Pliny prescribes a liniment of violet root and vinegar for gout and disorder of the spleen, and states that a garland or chaplet of violets worn about the head will dispel the fumes of wine and prevent headache and dizziness.

The root is a powerful emetic, and is frequently used to adulterate ipecac. A dose of from forty to fifty grains of the powdered roots acts powerfully, inciting nausea and great vomiting and nervous affection.

The leaves are an old popular remedy for bruises.

Of late years, preparations of fresh violet leaves have been used both internally and externally in the treatment of cancer. It is stated that an infusion of the leaves, or a syrup of the petals and a liquid extract of the fresh leaves, have been used with benefit to allay the pain in cancerous growths, especially in the throat, and as a cure for cancer of the tongue. The fresh leaves are also prepared as a compress for local application.

For lubricating the throat, violet leaves are dried, powdered, and allowed to stand in olive oil for six hours in a water bath.

Violet leaves, stewed in lard for an hour till they are the consistency of cooked cabbage, are good as an application for superficial tubercles in the glands of the neck, violet leaves tea being drunk at the same time.

The leaves and petals are official in the pharmacopœia for Portugal.

The flowers are emollient and demulcent. They were used in olden times as remedies in many disorders, and were supposed to be especially serviceable in ague, sleeplessness, and inflammation of the eyes.

'The flowers', says Gerard, 'are good for all inflammations, especially of the sides and lungs; they take away the hoarsenesse of the chest, the ruggednesse of the winde-pipe and jawes, and take away thirst.'

He adds: 'There is likewise made of Violets and sugar certaine plates called Sugar violet, Violet tables, or Plate, which is most pleasant and wholesome, especially it comforteth the heart and the other inward parts.' Violet sugar was a favourite conserve in the days of Charles II; it was considered of excellent use in consumption, and was sold by all apothecaries. The flowers have undoubted expectorant qualities; they are officinal in France.

A syrup is made from the petals which is a favourite household remedy for infantile disorders. In France syrup of violets is a medicine for cough and hoarseness. In England violets are cultivated largely at Stratford-on-Avon for the purpose of making the syrup, which when mixed with almond oil is a capital laxative for children, and will help to soothe irritative coughs, or to relieve a sore throat.

The seeds are purgative and diuretic, and have been given in urinary complaints, and are considered a good corrective of gravel.

A modern homoeopathic medicinal tincture is made from the whole fresh plant, with proof spirit, and is considered useful for a spasmodic cough with hard breathing, and also for rheumatism of the wrists.

O'Shaughnessy experimented with the dry plant as a substitute for Ipecacuanha, but without success.

Mohideen Sheriff considers it antipyretic and diaphoretic, and very useful in relieving febrile symptoms and excitement in all forms of fever, particularly in combination with other drugs of the same class.

'This is the "banafshah" of the hakims who value it as a strong febrifuge in acute and chronic fevers when given in combination with other drugs. Mohideen Sheriff in his Materia Medica of Madras gives the ingredients of a compound decoction which he found useful in relieving pyrexia of obstinate and long standing cases of typhoid fever, after European medicines, generally used, had failed. The same decoction was administered to a case of chronic fever without any benefit at all. In the out-patients a simple infusion of *Viola odorata* was given to several cases of pyrexia and intermittent fevers without benefit' (Koman).

Arabic : Banafsaj, Banafshaj, Behussej, Benephig—; *Armenian* : Manischar—; *Bengal* : Banafsha, Banosa—; *Bombay* : Banafshah—; *Calabria* : Rovesciole—; *Catalan* : Viola, Viola boscana, Viola de Bosch, Viola d'olo, Viola d'olor, Viola vera—; *Czech* : Fialke—; *Danish* : Martzfioler—; *Deccan* : Banafsha—; *Dutch* : Tamme viol—; *Egypt* : Benefshig—; *English* : Appel-leaf, Bairnwort, Banwort, Bessy Banwood, Blaver, Blue Violet, March Violet, English Violet, Fine-leaf, Sweet Violet, Vilip, Violet—; *French* : Fleur de mars, Jacée de printemps, Violette, Violette cultivée, Violette de mars, Violette odorante, Violette des quatre saisons, Violier commun, Violier de mars—; *Genoa* : Viuleta, Viuretta—; *German* : Blauoesken, Blauvoegschen, Blauvoelken, Maertzveilchen, Veielotenblau, Veieloteykraut, Veilchen, Viole, Wohlriechende Veilchen—; *Greek* : Ion, Menexe, Menexes—; *Gujerati* : Banaphsa—; *Hindi* : Banafshah—; *Hungarian* : Ibolya—; *Italian* : Mammola, Mammoletta, Viola, Viola mammola, Viola marzia, Viola zoppa, Violetta—; *Languedoc* : Memog, Memoi—; *Lombardy* : Zoppina—; *Marathi* : Bagabanosa—; *Persian* : Banafshah—; *Polish* : Skopek—; *Portuguese* : Viola, Viola roxa, Violata—; *Roumanian* : Micsunea, Tamaioasa, Toporas—; *Russian* : Packutchaya fialka—; *San Remo* : Viureta—; *Sanskrit* : Jvarapaha, Nilapushpa, Sukshmapatra, Vanapsa—; *Sardinia* : Violedda, Viuletta—; *Spanish* : Violeta, Violeta de olor—; *Swedish* : Aekta fioler—; *Tuscany* : Mammoletta, Mammolina, Viola maura, Viola mammola—; *Urdu* : Banafshah—; *Verona* : Fior de San Bastian—.

3. **Viola cinerea** Boiss. is found in Sind, Baluchistan, Waziristan, Punjab, Western Rajputana, and Kathiawar. It extends to Afghanistan, Persia, and Arabia.

This plant is used medicinally in Sind as a substitute for *V. odorata.*

Porebunder : Jinkobanafsha—; *Punjab* : Banafsha—; *Sind* : Banafsha—.

4. **Viola diffusa** Ging. is found in the subtropical Himalaya from Nepal to Mishmi at 3,000-5,000 feet, and in the Khasia Hills. It also occurs in China and Indo-China.

In Indo-China the flowers are given in diseases of the chest as a pectoral and bechic.

Annam : Dia dinh—.

5. **Viola Patrinii** Ging. occurs in the temperate Himalaya, China and Japan.

In China, Indo-China, and Malaya the flowers are said to purify the blood and the plant is used as a pot-herb. The plants are also bruised and applied to ulcers, foul sores, and swellings. They are prescribed in syphilis, scrofula, and biliousness.

Annam : Tu hoa dia dinh—; *Chinese* : Tzu Hua Ti Ting—.

6. **Viola tricolor** Linn. is indigenous in Europe, North Asia and North America. It is cultivated in India.

The fresh plant is reputed emollient, slightly laxative, emetic, and pectoral; it has been used with success in the treatment of nephritic and cutaneous diseases.

The Wild Violet, or Pansy, is a household remedy in many parts of Europe. The plant is taken internally in infusion as a depurative in skin cruptions.

'For curing milk crust and scalled head in children, a small handful of the fresh plant, or half a drachm of the dried herb, boiled for two hours in milk, is to be taken each night and morning; also a bread poultice made with this decoction should be applied to the affected part. During the first eight days the eruption increases, and the urine, when the medicine succeeds, has a nauseous odour like that of the cat, which presently passes off; then, as the use of the plant is continued, the scabs disappear, and the skin recovers its natural clean condition.'

In Spain the plant is considered to be stimulant, and is used in rheumatism and in skin diseases.

A homoeopathic medicinal tincture is made from the entire plant with spirit of wine. Hahnemann found that the Pansy Violet, when taken experimentally by provers, served to induce cutaneous eruptions, or to aggravate them, and he reasoned out the curative action of the plant in small diluted doses for the cure of these symptoms, when occurring as disease.

The flowered plant is official in Austria, Germany, Portugal, Switzerland, and Turkey.

The leaves were once esteemed in the cure of cutaneous disorders, and they are still employed in Italy in *tinea capitis*.

The root is said to have similar properties to those of Ipecacuanha, and is often used beneficially as a substitute by country doctors in England. An infusion thereof is admirable for the dysentery of young children.

Catalan : Herba de la Trinitat, Pensaments, Trinitaria—; *Dutch* : Driekleurig viooltje—; *English* : Bird's Eye, Bouncing Bet, Bullweed, Call-me-to-you, Cuddle Me, Cuddle-me-to-you, Cull Me, Flame Flower, Flamy, Flower o' luce, Gardengate, Gentleman John, Godfathers and Godmothers, Heartsease, Herb Constancy, Herb Trinitatis, Jack-jump-up-and-kiss-me, John-of-my-Pink, Jump-up-and-kiss-me, Kiss-her-in-the-buttery, Kit-run-about, Kit-run-in-the-fields, Live-in-idleness Love-in-idleness, Love-lies-bleeding, Love Idol, Loving Idol, Meet-her-i-th-entry, Meet-me-in-the-entry, Pance, Pansy, Pansy Violet, Paunce, Pink-eyed-John, Pink-o'-the-Eye, Stepmother, Three-faces-under-a-hood, Tittle-my-fancy, Wild Pansy, Wild Violet—; *French* : Clavelée, Fleur de la Trinité, Herbe à la chevelée, Herbe clavelée, Herbe à la clavelée, Herbe de la Trinité, Jacée tricolore, Pensée sauvage, Petite jacée, Violette tricolore—; *German* : Abnehmkraut, Ackerveilchen, Blauoesken, Denkanmich, Denkbluemchen, Dreifaltigkeit, Dreifaltigkeitskraut, Faulschken, Fioelken, Freisamkraut, Fresern, Gedenkemein, Gengelkraut, Hundsveilchen, Maukraut, Schwiegerle, Schwiegermuetterchen, Stiefmuetterchen, Tagundnachtblume, Tausendschoen, Unnuetzesorgen, Dreifarbiges Veilchen, Veilchenkraut, Wergehundkommnichtwieder, Vergissmeinnicht—; *Hungarian* : Arvacska—; *Italian* :

Penserio, Pensieri, Viola tricolore—; *Languedoc*: Pensado—; *Malta*: Pansy, Viola di tre colori, Pensieri—; *North America*: Cupid's-delight, Garden Violet, Heart's-pansy, Johnny-jump-up, Pansy—; *Portuguese*: Amor perfeito, Herva seraphica, Violeta tricolor—; *Spanish*: Amor perfecto, Nueras, Pensamientos, Suegras, Trinitaria—; *Roumanian*: Catifeluta—; *Russian*: Anyutini glazki—; *Turkish*: Hercai menekse—.

7. **Viola biflora** Linn. occurs in the temperate Himalaya, and is found in the northern temperate regions of the world. In Kashmir it is common in damp woods and under big rocks at 8,000 feet at Gulmarg; it is found at Khelanmarg 10,000 feet, on steep rocky hill-side at Tosh Maidan 9,600 feet; about 10,000 feet at Basam Gali in Juniper tract.

This violet is much used medicinally in Spain. The root is given as an emetic; the flowers as an emollient, pectoral, diaphoretic, and antispasmodic; the leaves as an emollient and laxative.

English: Two-flowered Violet, Yellow Violet—.

8. **Viola sylvestris** Lam. is found in Kashmir and Kishtwar at 4,000-8,000 feet, extending to Northern Asia and westwards to the Atlantic.

The plant is used in chest troubles as a bechic and pectoral. The stems, leaves, and flowers are bruised and applied to wounds and foul sores.

IV

The COCHLOSPERMACEÆ are trees, shrubs or rhizomatous undershrubs with coloured juice. They are grouped under 3 genera with about 18 species.

COCHLOSPERMUM.

This genus consists of 12 tropical species.

C. tinctorium Perr. is used medicinally in Gambia and Guinea, *C. insigne* St. Hil. in Brazil.

Cochlospermum Gossypium DC. extends from Garhwal to Bundelkhand, Bihar, Orissa, Bengal, Burma, Central India, Deccan, the Western Peninsula, the Madras Presidency in dry forests, especially on stony hills, in all districts, but less common on the west coast.

In Punjab the dried leaves and flowers are given as stimulants.

The floss has been recommended as admirably suited for padding bandages and splints, and the gum has been proposed as a substitute for Tragacanth.

The gum, sold in the bazaars as *katira* or *kathira*, is used as a demulcent and astringent. It is given in cough and hoarse throat in the form of lozenges and mucilage. Mixed with curds or whey it is largely dispensed in cases of diarrhoea and dysentery.

The gum is a Yunani remedy prescribed for the treatment of gonorrhoea and syphilis, for eye troubles and trachoma.

Arabic: Katira—; *Bengal*: Golgol—; *Betul*: Galgal, Ganiar—; *Bhil*: Ganeri—; *Canarese*: Arasinaburaga, Arisinaburuga, Bettatvare, Buruga, Gagili, Kaduburaga—; *Chota Nagpur*: Sisibaha, Udal—; *English*: White Silk-Cotton Tree, Yellow Silk-Cotton Tree—; *Gond*: Gangam, Ganiar—; *Gujerat*: Kadachogund—; *Hasada*: Hupudaru—; *Hindi*: Gabdi, Galgal, Gangal, Ganiar, Gejra, Kumbi—; *Kolami*: Golgal, Hupu—; *Lambadi*: Hoghara—; *Malayalam*: Appakutakka, Chempanni, Chimappanni, Panninara, Parapanni—; *Marathi*: Galgal, Ganer, Ganeri, Ganglay, Gongal, Gulgul Gunglay, Kathalyagonda—; *Naguri*: Galgalolaru—; *Nimar*: Galgal, Ganiar—; *North-Western Provinces*: Gajra, Kumbi—; *Persian*: Gone, Katira-i-hindi, Kokamara—; *Punjab*: Kumbi—; *Saharanpur*: Arlu, Gejra—; *Santal*: Hopo—; *Saora*: Onkur—; *Sinhalese*: Elaimbul, Kinihiriya—; *Tamil*: Kannigaram, Kattilavu, Kattolaga, Katupanju, Kattuparutti, Kongilam, Kongu, Kumarai, Malaiparutti, Manjardanakku, Nalal, Pachaigiluvai, Palini, Panjittanakku, Pinar, Sudinar, Tanakku, Turumorbalam—; *Telugu*: Adaviburaga, Akshotamu, Buraga, Gungu, Kondagogu, Kongu, Parijatamu, Pratti—; *Urdu*: Katira—; *Uriya*: Beniyamrydami, Ganiari, Konokopolaso, Kontopolas, Pobosokoniari—.

V

The Bixaceæ are shrubs or small trees with coloured juice. They comprise 3 genera with 6 species.

Bixa.

The genus consists of 2 species, natives of tropical America.

B. Orellana Linn. is used medicinally in Indo-China, the Philippine Islands, Brazil, Guiana, and Sierra Leone.

Bixa Orellana Linn. is largely cultivated throughout India.

The plant is used by Ayurvedists as an astringent and mild purgative, and is considered by them a good remedy for dysentery and kidney diseases.

The root-bark is antiperiodic and antipyretic, of great help in uncomplicated intermittent, remittent, and continued fevers.

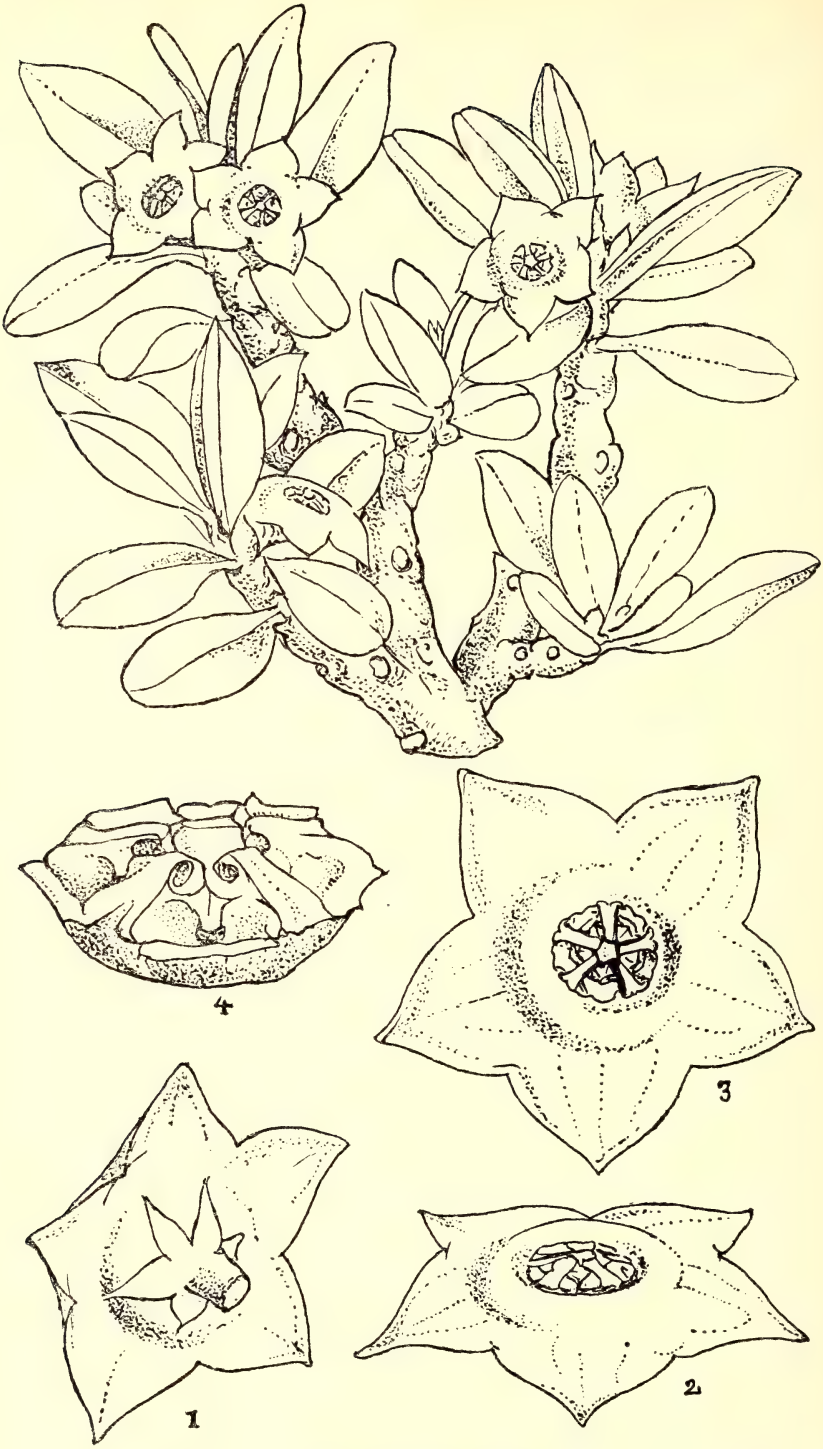
The leaves are a popular febrifuge in Cambodia. In French Guiana they are considered detergent; an infusion is prescribed as a purgative in dysentery.

The seeds are cordial, astringent and febrifuge, and a good remedy for gonorrhoea. They possess the antiperiodic and antipyretic properties of the root-bark, but to a smaller extent.

The seed pulp, a well-known colouring matter, has the same astringent and febrifugal properties as the other parts of the plant. It is used by American Indians to paint their body all over for full dress, and this use of it is said also to prevent mosquito bites.

The root in combination with other drugs has been recommended for internal use in snake bite (Bapat); but it is not an antidote to snake venom (Mhaskar and Caius).

Angola: Quisafu—; *Antsianaka*: Vahinamalona—; *Ashanti*: Konin—; *Assam*: Jarat, Jolandhar—; *Awka*: Nkbul-ufia—; *Bengal*: Latkan, Latkhan, Watkana—; *Bombay*: Japhar, Kesari, Kesuri, Kisri, Sendri, Shendri—; *Brazil*: Urucu—; *Burma*: Thideng, Thidin—; *Cambodia*: Chompuh chralok—; *Canarese*: Arnattu, Bangarakayi, Kesari, Japhredu, Kuppamanhala, Ragnamalar, Rangamali, Rangumale, Sannajabbale, Sannajapali—; *Chittagong*: Powasi—; *Deccan*: Shalkepandu—; *English*: Annatto, Annotto, Arnatto, Roucou—; *Espiritu Santo*: Nepekara—; *Ewe*: Berniticu—; *French*: Achiote, Achit, Achote, Ananaie, Anate, Atole, Bichet, Cochehue, Rocouyer, Roucouyer—; *French Guiana*: Rocou, Roucou—; *Galibi*: Ururu—; *Guam*: Achiote, Achuete—; *Guarana*: Urucuy—; *Gujerat*: Sinduri—; *Hindi*: Latkan, Latkhan, Rangphal, Vatkana—; *Honduras*: Anatto—; *Hova*: Sahy—; *Ibo*: Ula, Ula machuku—; *Ibuzo*: Ola, Ufie, Uhia nkum, Uhie aro—; *Indo-China*: Cham pou, Dieu nhuom, Som hou, Som phu, Xiem phung—; *Konkani*: Kesri—; *Lambadi*: Japrero—; *La Reunion*: Rocou, Roucou—; *Limba*: Kuburo—; *Lokko*: Mbundona—; *Malayalam*: Kuppamannal, Kurannamannal—; *Manipur*: Reipom—; *Marathi*: Kesari, Kesuri, Kisri, Sendri, Shendri—; *Mende*: Bundoi, Mbundoi—; *Mexico*: Achiotillo, Achiotl, Bija—; *Mundari*: Rangjodaru—; *Onitsha*: Ula, Ula machuku—; *Pentecost*: Waiang—; *Philippines*: Achiote, Achuete, Anate, Atola—; *Portuguese*: Arnotto—; *Samoa*: Loa—; *Sanskrit*: Karachchada, Raktabija, Raktapushpa, Shonapushpi, Sinduri, Sindurpushpi, Sunomala, Trivapushpi, Virpushpa—; *Santal*: Kougkuombi—; *Sinaloa*: Achiote—; *Sinhalese*: Kaha—; *Spanish*: Achote—; *Susu*: Kamunyi—; *Tagalog*: Achuete, Achute, Atsuiti—; *Tamil*: Amudadaram, Avam, Kungumam, Manjitti, Sappiravirai, Uragumanjal, Vennaivirai—; *Telugu*: Jabura—; *Timne*: Kam, Pu-bundoi—; *Tschaudjo*: Kirane—; *Tupin*: Urucu uva—; *Twi*: Brorfo agyama—; *Uriya*: Gulbas, Guliabha, Japhoran, Lotkons, Sakta—.



Frerea indica Dalz. A copy of Dalzell's plate published in the *Journal of the Linnean Society*, vol. viii, (1865), p. 10, t. 3.

ADDITIONS TO THE DESCRIPTION OF *FREREA INDICA* DALZ. (*ASCLEPIADACEAE*) AND SOME OBSERVATIONS ON THE SPECIES.

BY

CHARLES McCANN, F.L.S.

(*With* 3 *plates*).

Frerea indica Dalz., first discovered in 1864 by Nicol Alexander Dalzell, if for no other reason than the fact that it is a rarity, is deserving of attention and worthy of a note. As far as I am aware, it has only been found once since its discovery and that by Mr. Ranade, before Mr. T. Cooke had written the *Flora of the Bombay Presidency* (1908). Since that date I do not know of any botanist having found the plant. It is not only a rare, but also a curious plant. In appearance, it is a miniature of *Euphorbia nivulia*—without the thorns, but with stellate Asclepiad flowers and fruit. Dalzell evidently did not obtain the plant in fruit for he did not describe it in his original description. However, Hooker under the generic description describes the fruit as: '*Follicles* terete, smooth. *Seeds* comose'. Cooke evidently copied Hooker's generic description, but under the specific description says, 'Follicles not seen'! Cooke examined Ranade's specimen, but evidently it was without the fruit, or he would certainly have described them. On the assumption that the fruit have not been described, I give below a detailed description of the fruit, seeds and other parts, where necessary. The description is based on fresh material collected by myself at Shivner Fort, Junnar, Poona District. The plants were collected on the 23rd October 1938.

Genus: FREREA.

Dalzell created a new genus for this curious plant and named it after Sir Henry Bartle Frere 'not only as a mark of esteem and respect, but also because he always has been the enlightened encourager and promoter of scientific researches in India, and is himself a close observer of nature'. It is a monotypic genus consisting only of *F. indica.* The genus differs from *Caralluma* only in the remarkable feature that its stems bear true leaves. This character constitutes a link between the leafless species of more arid areas and the remaining tribes of Asclepiads.

Frerea indica Dalz. in *Journ. Linn. Soc.*, v, 8 (1865), p. 10, t. 3; Hook., *F.B.I.*, v, 4 (1883), p. 76; Nairne, *Fl. Pl. of W. Ind.* (1884), p. 187; Woodr., *Journ. Bom. Nat. His. Soc.*, v, 12 (1898), p. 168; Cooke, v, 2, pt. 1 (1904), p. 178; Blatt., *Journ. Bom. Nat. Hist. Soc.*, v, 36 (1933), p. 536; White and Sloane, *The Stapelieae*, v, 1 (1937), pp. 149-50.

The following description is mainly taken from that of Dalzell with slight changes and additions. The changes were necessitated by the examination of fresh material.

Description: A decumbent, sometimes pendulous, fleshy, glabrous herb with thick branches, at times exceding 2 cm. in dia.; young stems and branches green turning gray with age. Roots thick arising from the nodes and along the branches. Leaves 64×28 mm., oblong or ovoid, obtuse or sub-acute, fleshy, subsessile, margin entire, decurrent into the petiole. Flowers solitary or in pairs; pedicels arising between the petioles or near their bases, very short, elongating and thickening in fruit (5-7 mm.). Calyx glabrous, divided about two-third the way down; lobes deltoid, acute. Corolla rotate 20 mm. in dia., divided rather less than half way down; lobes deltoid, acute, fringed with fine hairs, purple, with a pale-yellow irregularly shaped spot in the centre of each lobe; corona purple, the outer copular with five broad short truncate or sinuate lobes, the inner of 5 linear truncated lobes incurved at the apex and inflected over the staminal column. Staminal column short; anthers red (Dalz.). Style-apex pearly white. Follicles 2, 87×6 mm., erect, slender, terete, tapering to a small rounded apex and slightly narrowed towards the base. Seed 9×5 mm., ovate or ovate-lanceolate, brown when dry; coma 15 mm. long.

Flowering and Fruiting: September to October or early November. The fruits mature towards the end of November and December.

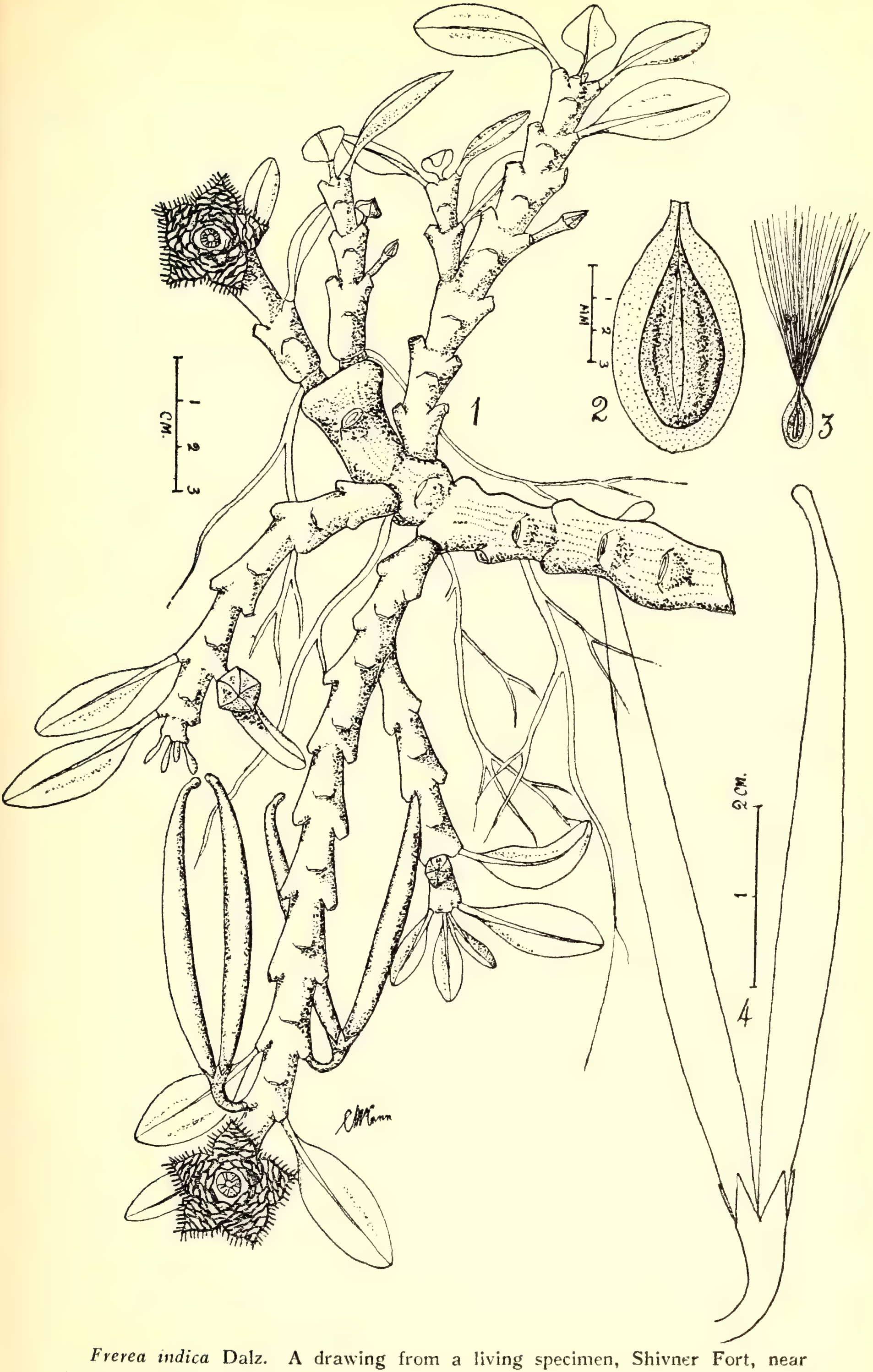
Habitat: Dalzell (l.c.) gives the habitat of his type, 'Concan, alt. 3,000 ped.'; Hooker (l.c.) who evidently had the opportunity of examining the type, as, 'The Concan; hill foot (*per errorem* "foot"?) near Hewra, alt., 3,000 ft.'. Hivra (Hewra) is a small village a little more than 10 miles east-south-east of Junnar, Poona District, Deccan. Cooke (l.c.) writes, 'A rare plant originally found by Dalzell on a hill near Junnar.' Ranade's specimens come from, 'Hill Fort, Junnar'. My own specimens come from the eastern face of Shivner Fort (Hill Fort, Junnar), Junnar.

Distribution: From the 'Habitat' recorded above it is clear that the plant is very local. It is apparently endemic to the Bombay Presidency as it has never been recorded outside its circumscribed locality on the Deccan.

Notes: *Colour of flower*: Dalzell describes the flowers as purple, etc. It has been my experience that newly open flowers are reticulated with bands of greenish-yellow and dull red-purple; with age both tints intensify, the former becomes yellow and the latter a richer red purple. The yellow then fades out and the entire flower assumes a deep red (almost black) purple. However no two flowers are alike in colour. The fringe of hairs is deep purple, like the rest of the flower, and is hardly visible until looked for.

Habit: On Shivner Fort the plant was growing on the almost vertical face of the trap rocks where tufts of *Tripogon* sp. had been established. The two plants were almost invariably associated. In such situations it assumed a pendulous character, clinging by its thick roots to the mud accumulated under such patches. On the 'shelf' it was rarely truly erect for more than a few centimetres, but the pendulous branches often exceeded 30 cm. in length. Old stems became a silver grey, but the new branches were a shining green. Due to dripping water the branches were covered with a thin solid layer.

PLATE II


1
2
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1 2 3 CM.
1 2 3 MM
1 2 CM.

Frerea indica Dalz. A drawing from a living specimen, Shivner Fort, near Junnar, Poona District.

1. Entire plant. 2. Seed. 3. Seed with pappus. 4. Fruit.

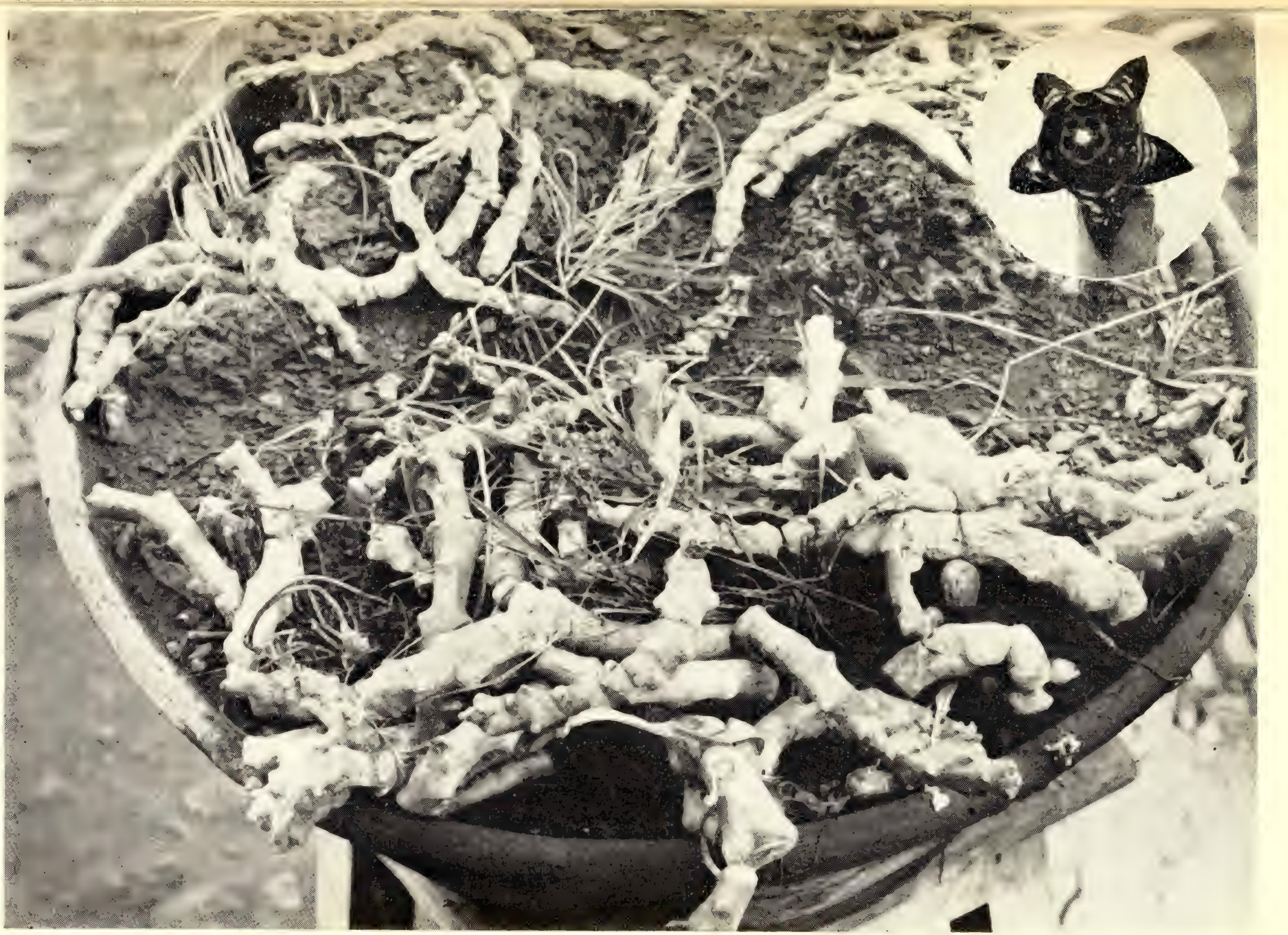

Photo C. McCann.

A rare Euphorbia-like Asclepiad, *Frerea indica* Dalz., from the Deccan.
Inset: Close-up of flower (natural size).

Unlike the closely related *Caralluma* of the Deccan hills, which is partial to the well drained hill-sides, *Frerea* appears to favour bare vertical rocks over which water trickles, at least during the monsoon months. The plants flourish best in damp situations. When the plants are washed off the rocks on to level ground they do not appear to thrive. The plants are evidently leafless during the dry season as only those collected in damp spots had leaves.

Cultivation: Specimens kept by me in pots seem to be doing well, both in the sun and in the shade, the only difference being that the tendency to elongate is greater in the shade specimens. Under cultivation the specimens, particularly the new branches, retain their leaves.

Dalzell: Before concluding this note a few words on N. A. Dalzell, the discoverer and author of this illusive plant, would not be out of place, therefore I give below a brief summary of his life.

Nicol Alexander Dalzell was born in Edinburgh on the 21st April, 1817. He graduated from the Edinburgh University where he took his M.A. in 1837. He was elected a Fellow of the Botanical Society of Edinburgh in 1836. He was Conservator of Forest, Bombay from 1841 to 1870. In collaboration with A. Gibson, he wrote the *Bombay Flora* (1861). He contributed to the Transactions of the Linnaean Society; *Journal of Botany* (1850-57); *Proceedings*, Botanical Society, Edinburgh, etc. His collection is at Kew. He returned to the place of his birth and died there in January 1878, at the age of 61.

MEMORANDUM ON THE KAHILU SANCTUARY.

BY

D'ARCY WEATHERBE.

WITH AN INTRODUCTION BY THEODORE HUBBACK.

(*With two plates*).

INTRODUCTION.

Mr. D'Arcy Weatherbe has asked me to write an introduction to his note on the Kahilu Sanctuary in Burma.

He has also asked me to express an opinion, based on his investigations and statements, regarding the value of this place as a Sanctuary.

I am sure scientists and conservationists throughout the world will be interested in reading this entirely disinterested report on what Mr. Weatherbe calls, and rightly calls, a 'so-called' Sanctuary.

Mr. Weatherbe has shown quite clearly that with the exception of the identification of parts of a skull of a *Rhinoceros sondaicus* obtained in the area, there is no evidence at all regarding the species of Rhinoceros in the Kahilu. No scientific data can be based on the evidence of village people, and the testimony of a native Game Ranger is seldom more valuable.

Mr. Weatherbe was satisfied after questioning the Game Ranger in the Kahilu on many matters relating to this area and the Rhino therein that his testimony was unreliable. From Mr. Weatherbe's description, the conditions under which these unfortunate animals exist, due to the failure of the Government to undertake any restrictions to avoid disturbance, makes the title of 'Sanctuary' for such a place a bad joke. In fact I might say that the encouragement to provide disturbance by allowing unrestricted 'Taungya' activities—the cut, cultivate and clear out policy—to go on over 50 square miles of the 'Sanctuary'; by allowing villagers to go in and out of the area as they please; by permitting men armed with guns and accompanied by dogs free access to the area; entirely discount and render ineffective what might have been a permanent and valuable refuge for wild life.

The Sanctuary as organized is valueless as a permanent contribution to the Cause of Conservation.

If the Government of Burma want to preserve the Rhinoceros in this area then let them undertake the work in a proper and business-like manner and try to emulate what has been and is being done in Canada, the United States and elsewhere, and draw up a proper constitution for this area to establish it as a real Sanctuary.

If the Conservation of Wild Life is merely to be looked upon as something which can be carried on so long as it does not interfere with anything else; which requires no special steps to be taken except those which might be described as marks on pieces of paper; then it will fail. The sooner it is recognized by Governments which profess solicitude for wild life, but who take no adequate steps to save it, and spend insufficient money to guard it, that their inactivity is fatuous and fatal, the sooner there will be some hope for a real policy of Conservation.

Mr. Weatherbe's report should be carefully studied. Presuming that the Government of Burma really want to preserve wild life, I feel sure that those in whose hands lie the destiny of the Wild Creatures of that country will take to heart the implications of the report.

T. H.

Note on a Visit to the Kahilu Rhinoceros Sanctuary.

The following geographic description of the Kahilu Sanctuary is taken from the report of the Game Warden in 1928 and supplemented by my own observations, as his data about communications are, perhaps, less up-to-date.

Comprising an area of approximately 62 miles, the Sanctuary is situated on the right bank of the Yunzalin river on the borders of the Papun and Thaton Civil Districts, and the Salween and Thaton Forest Divisions. Of the total area 16 miles consist of reserved forests (Kahilu Reserve 11 square miles and balance in the Tagelung reserve). As the portion in the Tagelung reserve is isolated, close to Kyowaing and the cart road, and as signs of rhino are said never to be found there now, it may, perhaps be left out of consideration. The other 46 square miles are public forest land, cultivations and village sites. The boundaries are notified as follows:—*East*—P.W.D.—Papun-Kammemaung cart road from the Kayindon Chaung in the north to Yebu Chaung in south. *South*—The Yebu-Lapotha-Kyowaing village cart track as far as the eastern boundary of Tagelung reserve, thence by the reserve boundary to the Donthami Chaung. *West*—the Donthami Chaung to Pinmalinawik village, thence by reserved forest department cart road as far as the Kayindon Chaung. *North*—the Kayindon Chaung to the starting point. The area may be reached by two routes. The first is from Thaton, on the Rangoon-Moulmein Railway, by motor car to the Dondami river, some seven miles, and then up this river by motor boat 55 miles to where a forest road, 20 miles long, connects with the village of Kyowaing, and this stage can be done, by special arrangement by bus. Kyowaing is at the south-western corner of the Sanctuary and has a comfortable Forest Rest House, while a cart road leads into the Sanctuary to the village of Lapotha, 8 miles from Kyowaing. By starting in the morning from Thaton, one can sleep at Kyowaing Rest House. The alternative route is from

Moulmein to Shwegun on the Salween River, 52 miles by I.F C. steamer which takes a day. Starting from Shwegun, with a motor boat, next morning, Kammemaung can be reached in about 4 hours, and, by arrangement, a bus can be had from Kammemaung to Kahilu Rest House, a distance of about 16 miles, so that this route takes over a day and a half, at best. The above itineraries refer to the dry weather season. While the total area comprises about 62 square miles a portion of this area nearly 12 square miles in extent within its borders forms part of a reserved forest and it is only this small area that in any way faintly deserves the name 'Sanctuary'. Within this Reserved Forest, there is no cultivation and there are no villages and the forest remains mostly uncut. The trees are largely evergreen and both fruit and foliage of a number of them, provide suitable food for the Rhinoceros. A number of permanent streams of good water intersect this forest reserve. In the portion of the Sanctuary outside the Reserved Forest and comprising some 50 square miles the greater part has been, and is being, annually cultivated by the Taungya method. For the benefit of those unused to this method, it should be explained that it consists, in each year, of cutting areas in the dry season, and, before the rains begin, in burning these areas. Immediately the rains commence, which in this region is towards the end of May, planting with paddy starts. By September the harvest has been gathered, and thenceforth, with the exception of some garden produce, chillies, etc., that particular area lies fallow for as long as from seven to twenty years depending upon the nature of the soil, and its relative fertility.

A very large and annually increasing population is dependent upon the crops grown within the Sanctuary area possibly now totalling 4,000 to 5,000 people. A Forest Official estimated, from official records, that the villages dependent upon this area comprised 669 houses in 1927 (the year before the Sanctuary was constituted), and in 1933, this number had increased to 869. The Game Warden stated in 1929, that 8 of these villages were actually situated within the borders of the Sanctuary itself, and contained 158 houses while 6 other villages were on the border with a large number of houses. Besides the 'Taungya' Cultivation, referred to above, wherever the rivers permit it, irrigated paddy land is cultivated, which with clearings for pasture, take a considerable area out of the total now available for the rhino. No restriction of any kind exists as to the locality or the extent of land cleared and cultivated and the villagers may cut or burn (outside the small area of the forest reserve) wherever or whenever they like. Traffic throughout the Sanctuary is completely unrestricted. Dogs can be, and are, taken anywhere within its limits. Besides cultivation, forest products of many kinds are collected and certain timbering operations carried on also, practically unrestricted. The rivers and streams are fished to extinction. In all of the villages whose inhabitants travel and cultivate, cut trees, or gather forest products, kill vermin and in all likelihood game and other birds, and some of the smaller fauna, fish, and cut tracks, there are licenses for not less than 30 guns. The

Game Warden reported 13 guns in the villages in the Sanctuary alone and a Forest Officer, that in two of the large villages the number of gun licenses increased from 12 to 16 between 1929 and 1933. These guns and dogs may be and are taken into the Sanctuary by a number of their owners who reside within its limits for, or ostensibly for, the protection of crops, lives or domestic animals and with them, or by other means, *any animal* including Rhino, Bison, Sambhur, Hog-deer, Tiger, Gyi, Pig, etc., as well as any birds, may be and doubtless often are destroyed. Only *after* the killing is an explanation necessary. Besides dogs and other form of 'protection' such as trapping, maroons and other noise, fire may be used for the protection of crops, and it must be quite obvious that the constant effect of any or all of the above disturbing agencies must keep the few rhino which are still alive here, in a great state of alarm and tension, and constantly on the move throughout practically the whole year. Besides the effect of this almost daily disturbance and alarming of the rhino, the depletion of their food supplies is serious and cumulative. After burning and harvesting are finished on these 'Taungya' areas the bulk of it comes up in dense bamboo, cane, high coarse reedy grass and thorny bush, none of which is edible by rhinoceros.

Reports during the past decade from various sources, and more frequent of late years, have led us to suppose that specimens of the rarest of all contemporary species of Rhinoceros may still be found at Kahilu in Burma. I refer, of course, to the Javan or Lesser One-horned Rhinoceros (*Rhinoceros sondaicus*). When travelling in Burma during some 5 months in 1937 and 1938, I determined, if possible, to investigate this question on the ground. *One* of the last if not actually *the* last specimens of this species known to have been killed, in Burma, was shot by Theodore Hubback in Lower Tenasserim in 1920. This animal, a female, was mounted and is in the South Kensington Museum. Later, in 1932, a large female was shot in the State of Perak in Malaya. This specimen is likewise in the British Museum. Since the shooting of this last Javan rhino, and with the exception of those reported in south-western Java, the animal itself has not been authentically reported, as far as I am aware, unless of course, and as one hopes, these rhino at Kahilu, belong to that species. Otherwise, although an odd specimen may still exist elsewhere, in Malaysia or in Indonesia, the possibility is that the death rate exceeds the birth rate, and so for all practical purposes the species must be considered as extinct. It may be imagined, therefore, with what interest I set about my visit to this Sanctuary, where, from all reports, not only were there still survivors of this species, but breeding was taking place. In this quest to try and verify if possible, the statements made, I was given every assistance and hospitality by members of the Burma Forest Department.

It is now over ten years since Burma's first Game Warden, a member of the Forest Service, surmised that the Javan rhino might be found here, and visited the place in 1927. This forest area is not far from the right bank of the Salween River and some 100 miles perhaps, above Moulmein. The Game Warden on that occasion, was accompanied by another member of his service, and though no animals were seen, tracks and other evidence of the presence of rhino, were observed. In the following year the Burma Government set aside an area of some 62 square miles as a Sanctuary for the rhino in this locality. The place was legally constituted as a Sanctuary in July 1928, and a Game Ranger was appointed shortly afterwards and has remained in that position ever since. In July 1928, a few completely decomposed remains of a rhino were said to have been found by some native women during the rains; but it was also alleged that the whole of this animal was removed by natives. There is no direct evidence as to where the animal had been killed or died, but fragments of a skull said to belong to it were some time later on secured, and sent to the Bombay Natural History Society for identification. The skull was that of a Javan rhino (*Rhinoceros sondaicus*).[1] In 1929, the Game Warden visited the area but was unsuccessful in 'viewing' rhino, though further evidence (tracks and other signs) were seen and his conclusion then was that there were not less than three animals living there. On March 6th, 1931, two members of the Forest Service, on a report of some rhino remains having been found, went to a locality close to the eastern boundary of the Sanctuary, and were shown completely decomposed remains of a rhino which had been, so it was reported, first observed by a villager in October, 1930. When the Forest Officers went there in March five months after its alleged discovery, there were only some bones mixed with debris to be seen in a river bed, to which position it is inferred they had been carried by the freshets, though this is not certain as October to March is normally the driest season. It is stated in the report made by one of the Forest Officers that the villager was frightened to report the find at the time; he reported that there were *dah* (knife) cuts on the sides and belly of the animal when he first saw it. During the same week of the alleged 'find' it was authentically reported to the police that fresh rhino blood was on sale in a nearby village. Notwithstanding all this very circumstantial evidence of the animal having been illegally killed, the conclusion drawn was that it had met its death in a trap, presumably a dead-fall, though no evidence of any kind is put forth in the report to substantiate this assumption. No evidence of identification of the species or sex of this animal exists but I believe it was assumed to be a female. Why, I do not know. Now, to me, the chief importance of these two incidents is the fact that in the first three years of the existence of the Sanctuary, at least two rhinos are known to have met their death there, and though there were two Game Rangers on the ground, nothing was known of the latter event at least, for some five months afterwards. That is what I assume, as I cannot think that, had the fact been known to the Game Ranger, it would have been concealed. I point this out as important, and strongly opposed to charitable opinions expressed elsewhere that the rhino at Kahilu are quite safe with the local Karen. The incidents indicate clearly that it is not impossible, especially in the rains, that other rhino may have been killed here, the fact hushed up and the remains completely removed. With regard to the villager's alleged altruistic attitude towards the rhinoceros, I fear I have much less confidence than others who have reported on this subject. Another rather silly piece of native gossip has, by repetition in Forestry reports, been given such prominence that outside readers may accept it as a firm fact, and that is, that superstition would also prevent them from killing a rhino. One of these writers himself, however, naively states : 'but, for a few years before the Sanctuary was formed they (the rhino) were much harassed by hunters, who killed five or six in a comparatively short time.' Is it the inference that altruism and superstition has only become a safeguard *since* the constitution of the Sanctuary, otherwise, why this mysterious 'change of heart' among the Karen? Several thousands of these tribes-people live or depend for existence on the area enclosed in this violable Sanctuary. It surely cannot be seriously contended that among this community, there are no longer a certain proportion, as formerly, who could not withstand the temptation of securing the relatively high remuneration from the products of a rhino, were opportunity easy and risk small? Let us be practical in this matter, and admit that it would be the height of folly to depend either upon the altruism or upon the alleged superstitions of some 4,000 Karen natives for the safety of this handful of rhino. Prevention is much better than cure as unfortunately in this case, the latter does not exist. After the Game Warden's visit in 1929, the next inspection of the Sanctuary by a European was four years later, when a member of the Forest Service was sent there to report on conditions. He visited the place in March 1933, and was in and about the Sanctuary for some three weeks. During this time he reported on having visited the wallows and followed and inspected the tracks of rhino and interviewed natives. This report apparently based, to some extent, on the Game Warden's reports and, similarly to those reports, depends largely on information from local natives and more particularly from the Game Ranger. On the second day of his visit and before he had had an opportunity of seeing the Sanctuary itself this Forest Officer was fortunate in actually *seeing* a Rhinoceros. The spot as indicated to me by the Game Ranger, was on a small stream bed near the northern border of that portion of the Forest Reserve, which lies within the Sanctuary limits. Curiously this was also the first occasion on which the Game Ranger had seen a rhino in the Sanctuary though then in his fifth year of residence. This 'view' is the sole ocular evidence that is on record by any European of the presence of rhino at Kahilu, either before or since the constitution of the Sanctuary, and obviously as most of the other evidence extant points to the present rhino at Kahilu being smaller than mature *Rhinoceros sondaicus*, it is of the utmost importance that we examine the conditions carefully and in detail. First, it will be best to give the Forest Officer's own words in describing what he saw.

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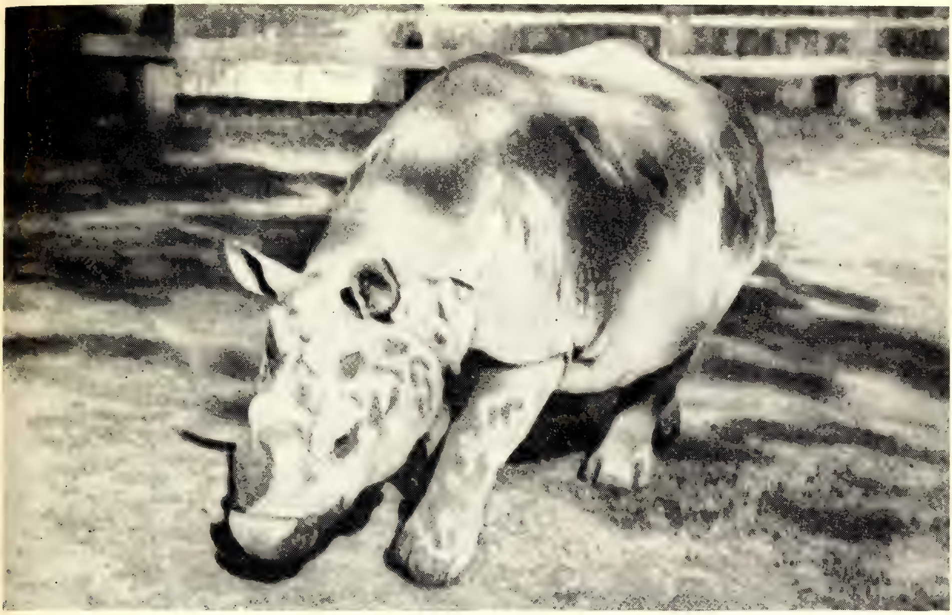
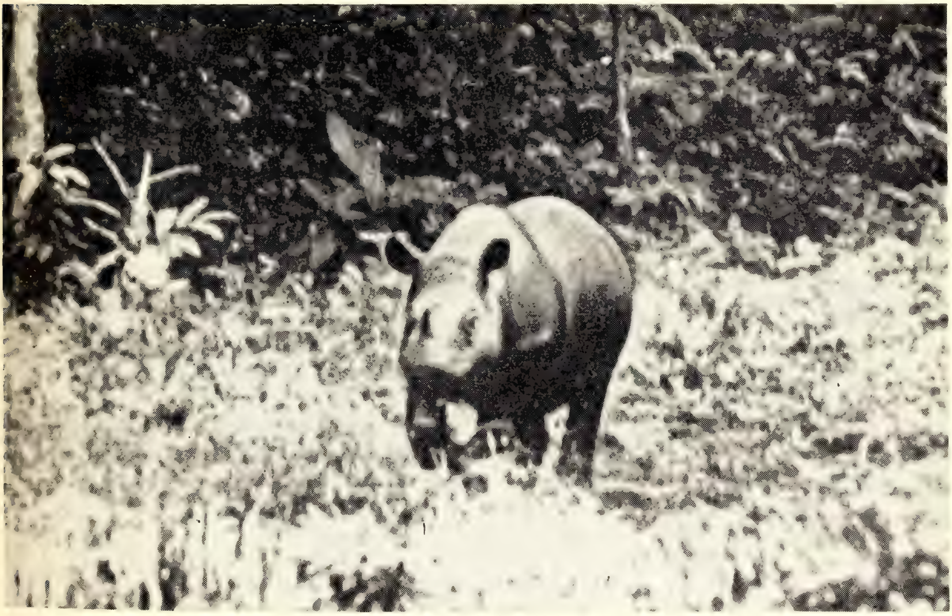
[1] A second and complete skull of *R. sondaicus* was presented to the Society by the Forest Department, Burma in 1933.—EDS.

He writes:—'The animal was encountered feeding with another *which was not seen.* It was walking slowly through the vegetation about 50 yards from me, but was sufficiently clear for me to say that it carried one horn about 9 inches long, set back slightly from the tip of the snout, and to estimate its height as 4 ft. 9 ins. to 5 ft. at the shoulder. It was not possible to obtain corroborative evidence of its species from the texture or folds of the skin, the light being too poor for these details to be visible. *The shade was so dense* that at 8 o'clock on a sunny morning, I should have required a flash-light apparatus to photograph the animal.'

I have questioned the Forest Officer as to this view, but, as it was some five years after the occurrence, he could not, without his diary, give any further details. He emphasised the indistinctness of the animal, that it was at least 50 yards away, and that the light was exceedingly bad. As a photographer, I am not clear as to the import of his reference to the use of a flash-light in daylight, but on one point, he is emphatic, and that is that he was definitely unable to identify any details of the animal's skin. As this is really the most important evidence that he might have got had conditions been better, it leaves us practically in the dark as to the species of this animal. A rhino, about 150 feet away, in thick bush, in semi-darkness, plastered with mud as he would have been having just come from a wallow, would, indeed, be a very difficult beast in which to identify details, yet, the Forest Officer does not hesitate to estimate his height within 3 in.; i.e. between 4 ft. 9 in. and 5 ft., and estimates his horn at 9 in. in length. (The record *R. sondaicus* horn is $10\frac{3}{4}''$), and that he was a male; but perhaps that was inferred from his having a horn, and therefore, that another rhino whose tracks *only* were seen later on, was a female. Now referring to the horn, published in the last issue of this *Journal* are three photographs of rhino (*vide*, the Two-horned Asiatic Rhinoceros (*R. sumatrensis*); Theodore Hubback, *J.B.N.H.S.*, vol. xl, No. 4, pp. 594-617, pls. iii, iv, and vii). The first two were taken in a much better light than in the case of the Kahilu rhino, as, instead of having to use a flash-light, they were taken in daylight, not long after midday, in an open salt-lick. One with a stop of F3.5 and $\frac{1}{8}$ of a second exposure, ('A') and the other ('B') with a cine camera. They are unique and I believe, the only two photos of a *Dicerorhinus sumatrensis* that have been taken in natural wild conditions, and yet both might be of a one-horned rhino. The posterior horn of the *D. sumatrensis* may be so insignificant as to be unobservable, even in a fairly good light, and, as both male and female have horns, that feature of the animal is not sufficient, alone, upon which to base its gender. The other photograph I mention and exhibit is one of a *Rhinoceros unicornis* ('C'), taken by myself with F8 and 1/25 second in broad daylight, and at ten yards distance (in captivity, it may be observed). It would be difficult to swear that even this beast in



The Great Indian one-horned Rhinoceros (*Rhinoceros unicornis* L.) approaching camera.



A male Asiatic two-horned Rhinoceros [*Dicerorhinus sumatrensis* Cuv.] in a salt lick in Malaya.

(*From a photo by T. R. Hubback. Copyright reserved.*)

that position had one horn or two, and under difficult light conditions, quite impossible. In this connection a note from C. W. Loch's interesting article in the *Journal* of the Malayan branch of the Royal Asiatic Society, September 1937 is interesting. It states:—'It must be remembered that all statements of occurrence of the *sondaicus* are open to doubt, though given in good faith. The identification of the species can only be accepted from persons competent to give an opinion on the matter. It sometimes happens that the second horn of *Rhinoceros sumatrensis* has been broken off and in any case natives cannot by any means distinguish between the two species. *In fact the animal can only be definitely identified when a specimen has been shot and examined at close quarters.*'[1]

Rhino, like buffalo, and some other animals, crave, indeed must have, wet and muddy places in which to wallow, many of which, doubtless, contain mineral salts or medicinal earth, which seem also to be a practical necessity to the well-being of the larger fauna, and not least of them, to the Rhinoceros. Before visiting Kahilu, I had asked a number of people as to whether any of these salt-licks as they are called, occurred in the Sanctuary, but none could tell me. As these places are usually the most favourable in the jungle in which to observe or photograph, one of my first questions to the Game Ranger was as to the locality of any salt-licks, but he could give me no information nor had he, so he said, ever observed any. By chance a rhino visited one of the largest wallows the day after we were there, and, gave unmistakable evidence of eating and licking the ground at one special place. The Ranger saw and confirmed this occurrence himself.

Even in the comparatively small area of the forest reserve, within the Sanctuary limits, the rhino are not entirely free from disturbance, there being a well used footpath from the village of Lapotha to Shweye which passes directly through the reserve from north to south. Certain villagers have the right to collect forest products within the reserve, and do so, and every stream is fished whether they have the right or not. The Game Warden in his report states that one village also has the right to hunt in the reserve and certainly turtles, lizards and other vermin are hunted within its limits; and all the streams show signs of constant 'cutting of tracks'. Dogs, of course, are taken on these peregrinations. So that even in here, there is no immunity from disturbance. Cultivation, however, is not carried on there—and food supplies, to my knowledge, consisting of at least two varieties of trees, and one fruit (and probably a number more of each), exist in fair quantity. The Rhinoceros is a ranging animal and the area of the forest reserve alone would I should think be too small for a number, all through the year. Though the Game Warden and Forest Officer in their reports agree that the few animals remaining here are largely confined to the reserved forest, and from what I have written above the reason must be quite obvious, one reason for their leaving its comparative protection and peace, is the practical necessity to visit the wallows and salt-licks, outside the reserved forest, more especially at the latter end of the dry season, when so many of these places are rapidly drying up. The attraction or possibly the necessity for certain fruits or other food might also necessitate their travelling beyond the boundaries. But it is apparently very rare to find their tracks outside the Sanctuary border. I visited the place at the end of March arriving on the ground on the 30th of that month, and leaving on April 6th. During that period, we had only two hours of rain which did not in anyway interfere with the very strenuous work of my examination. Besides the Game Ranger, and his Assistant, there were with me in camp and during the period of my sojourn on the ground, the chief Forest Ranger of the Division, the local Forester of the Reserve, and a Forester, who accompanied me from Thaton, and who spoke English more or less fluently. The Forest Ranger has a good knowledge of English and the Game Ranger and the assistant understand it passably. With one exception, I visited all of the wallows, said by the Ranger to be known to him, and some of them several times, but I cannot help thinking that there must be others which we did not see, unknown to him, and also that more of them are salt-licks than he realizes. In fact he, as I have stated, had apparently not known that any of these wallows were 'licks' until I pointed out that probability. The one known wallow (said never to dry) which I was unable to reach, though we tried to do so, lay too far away to go there and back in one day, under the existing conditions of the jungle. I think that I visited, practically the whole area, frequented by rhino, at that season, and though we did not actually see a rhino, we narrowly missed doing so.

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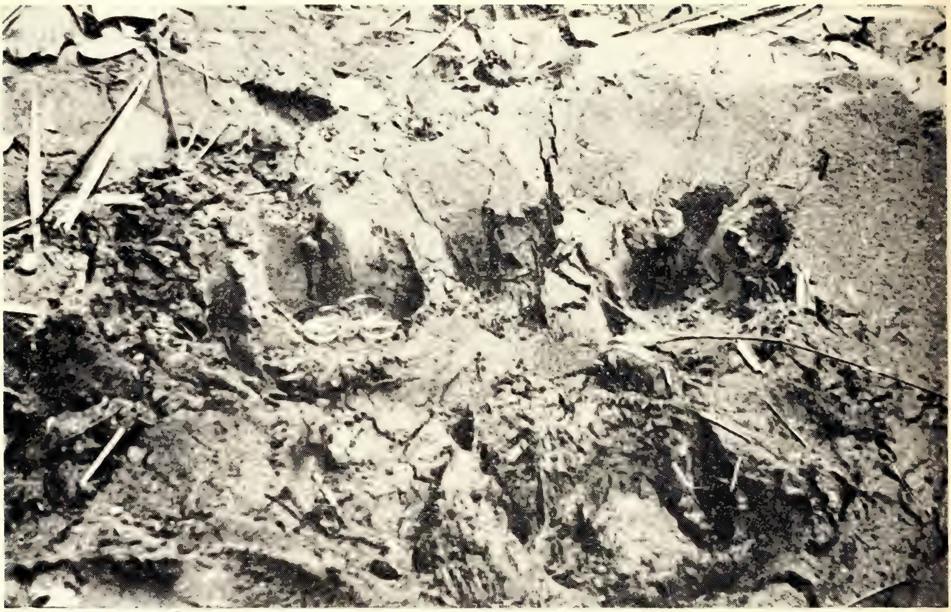
[1] The italics are mine.

Besides visiting and carefully examining many wallows and their surroundings and photographing and measuring tracks for 7 to 8 hours each day, I followed rhino paths and stream beds, where their tracks followed or crossed. Though I observed a great number of foot-prints of rhino, I only saw a comparatively few places where they had fed or slept or other signs of the animals except mud-smears near the wallows, but what impressed me most were the remarkably few droppings either fresh or old, that were to be seen. In only one place were they deposited in any quantity and these might have been a year old. This might be thought the more surprising in comparison with the large number of tracks seen, but to me it constituted the very strongest evidence of the very few animals that exist, in this locality. It must be remembered that at the time of my visit 6 months of the dry season had passed and tracks in soil containing any clay ingredients at all, might remain for years on end, unless obliterated by rain. In this jungle, wind may be disregarded as a disintegrating agent, though in parts of Africa and elsewhere it is the only one. The clearest and most easily measured tracks I saw were in a baked wallow, on an eminence, and probably at least two months old. I saw them in April and the last rains, of any amount, before that were, I believe, in February. I venture



Footprints of *D. sumatrensis* in dried wallow.
(*Widest measure of print* $7\frac{1}{2}$ *in. The spectacles are exactly* $4\frac{5}{8}$ *in. across*).

Footprints of *D. sumatrensis*.
(*The widest track at Kahilu, under* 8 *inches and fairly fresh*).

to suggest that these two points have not been sufficiently taken into account in previous estimates of numbers of rhino remaining.

The Measurements of Tracks.—I measured I should think, in all perhaps some thirty or more seperate footmarks though I saw a good many more. Wherever there was any chance to take an accurate measurement of the width I did so with extreme care. I used for the purpose a 5 foot tested tape measure, graduated in inches and tenths on one side and millimeters on the other. The Forest Officer in the report already referred to does not say how his measurements were taken. I understand that the Game Ranger's estimates were used in some cases. The Game Ranger's measurements, wherever I saw him make them, were, literally, by rule of thumb (and finger); he apparently does not carry a measure.

Some Comparative Characteristics of the Java Rhinoceros and the Two-horned Asiatic Rhinoceros.—The first of these animals, when mature, stands 5′ 6″ at the shoulder or even more. The width of the fore foot of a mature animal might be from 9″ to 11″ or wider. His coat has polygonal scales and is heavily folded round the neck with a deep double fold underneath. It is characteristically folded down the back of the shoulder and across the top and below the fore legs, almost as if a cape were worn. There is a fold in the skin down the junction between the hip and body. There is sometimes a slight fold across the rear and upper portion of buttocks as in the *R. unicornis*. The skin, however, is not so fantastically folded, as this latter species. The single horn of the male *sondaicus* is generally wide at the base and in great age, is often, much worn and splintered. The record length is only 10¾″. The female sometimes carries a horny nasal protruberance, in that position. The head of a *R. sondaicus* is bigger and heavier than *D. sumatrensis*, while the muzzle is not as short or square as the other one-horned rhino, but is inclined to be long and rather pointed or rounded and the upper lip overhanging.

The *D. sumatrensis*, both male and female, carry horns and the posterior one, *even in the male*, is often so insignificant as to be negligible at a distance. This is the smallest of all the existing species of rhino, measuring, in the mature animal, only four feet to about four feet six inches at the shoulder. The width of the foot of a full-grown two-horned Asiatic rhino, is from 6½″ to 9″ in width, but rarely of the latter width. His skin is much smoother than the *sondaicus* without the abnormal folding and wrinkling of the skin round the neck. The curious appearance, almost like the *R. unicornis*, of the skin of the *sondaicus* nor its scales has ever even been referred to in any report of the rhino at Kahilu, either by Europeans or natives, that I have heard of, yet it ought, as I have tried to show, to be a much more certain identification than the horn, to the uninitiated. I submit photographs which will more or less clearly show the difference, mentioned above, but unfortunately, have not been able to provide one of the male *sondaicus*.

The Rhinoceroses at Kahilu.—In critically examining all the data we have of these animals, our obvious main quests are as follows:—

1. What are their species?
2. How many animals exist there today, and of these how many are (*a*) male, (*b*) female, and (*c*) young or immature?
3. What evidence have we of breeding in the past?
4. Can breeding go on under present conditions? or if not—
5. What are the prospects of breeding under improved conditions?

Beyond the mere fact that we are certain that a few rhino exist at this place on close analysis, the sum total of our evidence as to (1), (2) and (3), is lamentably small, indefinite, and often conflicting.

It consists wholly in the reports already mentioned, the periodic reports of the Game Ranger, and with what meagre further details, confirmatory or otherwise, and largely critical I fear, I have been able to supplement the above.

As regards (1), there does not appear to be sufficient ocular evidence to settle the matter for a moment, the only reliable ocular evidence, in my opinion, being that of the Forest Officer which as I have, I think, clearly shown is inconclusive. Neither the first Game Warden nor I have seen a rhino at Kahilu and even assuming for the moment that the Game Ranger's testimony of having seen rhino twice (other than the case of the Forest Officer's rhino) is true, the first occasion, at night *with a torch*, may be ruled out, for our purpose of identification, and no definite identifying evidence has been offered in his second case, I have elsewhere pointed out in detail the reasons why I cannot accept this testimony as conclusive either.

So that our case for *R. sondaicus* rests, first on the evidence of fragments of a skull having been identified by the Bombay Natural History Society as *R. sondaicus*, and second on the measurements of footmarks and mud smears on trees, etc. As regards the first, where did it come from? It is alleged that it was found among bones and debris, in the rain, by some native women. There is no evidence that it was not the leaving of a poacher, brought to a village long before, but even if from an animal killed here in 1927, eleven years ago, it need have little or no bearing on the animals living here at present, and in their identity alone are we at the moment interested. I am not clear as to the suggestion that these animals must be *sondaicus*, because the *terrain* is not '*sumatrensis* country.' I do not quite know what is meant by the term. Although today these almost extinct animals are where you find them, there was no such thing as *sumatrensis* or *sondaicus* country in the past. Let me quote an extract from Waller's *Das Indo-Malay Archipelago und die Geschichte Seiner*, published in 1902. It says, speaking of the Javan Fauna, 'the Javan Rhinoceros (*Rhinoceros sondaicus*) "Sarak" in Javanese and "Badek" in Sundanese, differs from that in Sumatra in having one horn instead of two. *It ranges over the highest mountains* and its regular paths worn *into deep* *channels may be traced up the steepest slopes, and round the rims of even active volcanoes.'* The italics are mine, and I may observe that the volcanic mountains in Java are sometimes over 10,000 feet in height!

The description of *D. sumatrensis* in *Encyclopædia Britannica* describing the fauna of Sumatra states: 'The Sumatran Rhinoceros differs from the Javanese in having two horns like the African variety. *It is commonest in the marshy low lands*, but extends to some 6,500 feet above sea level.' Again the italics are mine. In lower Burma until the *sondaicus* became extinct both they and the *sumatrensis* lived in the same country. In 1920, a *sondaicus* was shot in Lower Tenasserim and the hunter during the same visit got up to a *sumatrensis*. In Malaya, in lower Perak and Northern Selangor, both species were found in the same country. Though generally speaking, the *sumatrensis* are fond of the mountains and one would not, perhaps, expect to find *sondaicus* there *now*, one was actually tracked right across the high ranges from the Pak Chan Valley to the lower Tenasserim coast. Rhino, supposed to be *sumatrensis*, are, I believe, today, found in another part of Burma in country not dissimilar to Kahilu, and in Indo-China the habitat of each was not dissimilar. So far as the measurements of footprints go, those made by the first Game Warden, the Forest Officer, and myself do not vary greatly, and the reliable records in firm ground would probably indicate feet between 6½ and 8½ inches in width. All these measurements and the mud smears would indicate animals rather of the *D. sumatrensis* than of the *R. sondaicus* species; or, if *sondaicus,* then, the measurements made by us must all have been of immature animals. There is, of course, always the bare possibility that here we have an undiscovered, or still unidentified species, or sub-species. Now with reference to (2), I was at Kahilu at exactly the same season as the Forest Officer. The Game Ranger stated that all climatic and physical conditions were identical and presumably so they would have been. I have already pointed out and it is obvious to anyone who has travelled in this particular place and under similar conditions, that *unless* one has actually seen tracks in a spot where he has been a short time previously, and seen none, it would in the great majority of cases, be impossible to accurately estimate their age, within a few days, at a minimum. The Forest Officer does not give the necessary detail as to where or under what conditions he saw two pair of tracks on the same day, and how far apart they were; nor in fact, is it clear that he did this tracking himself. I knew from hard experience, just how far it is possible to travel in that particular jungle in a given time, and how very much faster a rhino can do the distance, and to be convinced that he himself saw and measured four tracks in the same day that were indubitably different rhino, much more detail would have to be given than he affords. The Game Ranger's testimony on this point, I cannot, I fear, accept. His alleged ability in deciding whether a track is male or female sounds uncanny, but in practice I did not find it so. In no case either in wallow or elsewhere, and invariably with the Game Ranger, did I or he see unmistakable evidence of more than three tracks that, we could feel reasonably sure, were different; and that was chiefly due to my measurements. Only once in the whole time and area covered did I see fresh droppings, as fresh as say, perhaps one day old, and then of one animal only, and only in two cases as fresh as possibly a month. I personally can give no opinion except surmise, as the Game Warden did, of two animals, apparently together, being probably male and female, from the relative difference in the width of their footprints, and so we come to the question of breeding. None has any personal evidence on this. I have been told by a member of the Forest Service that reliable evidence exists as to calves being born in 1928 and 1935. All the evidence there is, is as follows, and no immature animal has ever been seen :—

The report of a native villager is given by the Game Warden as in 1928 having seen the tracks of an old rhino and those of a very young one together, sizes of tracks are not given and would doubtless in any case be unreliable. The smaller track was shortly after not seen again, and it was surmised it had gone off on its own, though only a few months old. It was hoped, the report says, that it would soon be rediscovered.

The only further evidence is of a track said by the Game Ranger to have been seen by him several times, measuring about five inches in width. Knowing how this individual measures the width, this track could have easily been 6 inches, the size of a hindfoot of a semi-mature *sumatrensis*. I was given a tale by another member of the Forest Service, before visiting Kahilu, of Karen natives having watched from a machan, two rhinos mating. Recently, however, I have received a copy of a most curious report made by a forester at Kadaingti in July, 1933, and addressed to the S.D.C. Thaton. It is written in English of a sort, but whether this copy is of an original, or is a translation, I cannot say. It states in effect, that he and a villager saw rhino tracks and following them, saw blood on the leaves. He had never seen a rhino in his life before. They followed and heard the animals *roaring*. They climbed up a tree 10 or 15 feet and saw two rhino, one with a horn 'which is about a foot in length just below the eyes,' and the other, the female, 'with a bulging thing on the nose-ridge.' After ten minutes the rhino left, and the forester went away in the opposite direction. He describes the head as *'resembling a pig, and on the whole, the animal resembles an elephant, where the tail looks like a pig.'* Referring to the blood on the leaves, he states 'The blood smells as rhino's blood as used for medicine, but with stronger odour.' Without giving any specific reason in the report he infers that the blood is from the rhino menstruating as the village elders have told him that the rhino have this habit. The story as told, sounds much as a village elder's tale would. I do not know if this is the same forester I saw at Kahilu, but the tale sounds like his that I have quoted before.

In face of all the foregoing the official Game Warden's report for 1936 says: 'The Head Keeper could not substantiate *his* *estimate* of eight Rhinoceros (*Rhinoceros sondaicus*) made last year and the number of these exceedingly rare and *valuable* animals is now estimated to be six'. It is reported that these animals used to leave *the Sanctuary*, during the dry season and graze outside Kahilu and as there is no other source of information except from the Head Ranger the above information is obviously entirely from him, though I should not have thought he would have been responsible for the statement of these animals 'grazing'. The only Asiatic rhinoceros that grazes is the Great Indian Rhinoceros. I should like to know how the Game Ranger estimated these eight rhino in the reserve. It must have been at some time after the Forest Officer's visit. How did the number increase so suddenly and most particularly do we wish to know what he believes has happened to the other two? There has obviously been a misunderstanding in the compilation of the report and for 'Sanctuary' should probably be read 'Reserve', as it has never been alleged, to my knowledge, certainly not in previous reports, that the rhino are in the habit of leaving the 'Sanctuary' limits. I understand that the Game Warden's report for 1937 has not been issued, but in the Rangoon Gazette in April, an extract as follows is given:—'*The* six *Rhinoceros sondaicus* were *accounted for*, again italics mine.' I should be interested to know whether the definite statement in each report that the rhino is *sondaicus* comes from the reports of the Game Ranger or whether this has been inserted by the Game Warden. Certainly, no Rhinoceroses were seen by the Game Ranger in either 1935 or 1936. Nor have I heard of any further evidence offered in either year, other than I have reviewed in this report. It is official reports, on which public knowledge of the Kahilu rhino is based. It would seem to be most important that sources of any new information should be given in detail. In the Rangoon Gazette of March 12th, was an article on Wild Life Conservation, which after stating that the Kahilu Sanctuary is one of the 'most interesting in the world', goes on to make the surprising assertion that since the foundation of this Sanctuary the stock has increased from 5 to 7 animals and the author states that there are now three males and four females. He further volunteers that the cow only produces a calf once in three years.

The writer of that article has also never been to Kahilu. From what private sources does all this 'information' come? Most of it must be imagination or based on native gossip. As to the period of *gestation* and the average time of production given above, who can tell? The greatest living expert on the subject, who has for years tracked and hunted Rhinoceros, and who has shot both *sondaicus* and *sumatrensis*, believes from his long experience, that the period of following the mother is much nearer *six years*. Be that as it may, theory has little to do with this matter. It is not here a question of periods but of the conditions, under which these few wretched animals exist, that affect their breeding. One has only to have the slightest knowledge of the ecology of the Rhinoceros—the Javan species is by no means the least sensitive of the five known—to realize that the slow rate of breeding under the best conditions and the extreme sensitiveness of the female to disturbance will, if at all excessive, probably prevent procreation altogether. I think, therefore, from the facts given above, in connection with this very mis-named 'Sanctuary' the chances of rhino breeding there under present conditions are thousands to one against, and I cannot conceive upon what possible grounds the following statement in the Forest Officer's report is based, 'there seems every prospect of the stock of *sondaicus* growing considerably in the next ten or fifteen years.' Five years of that time has already passed and whatever allegations there may have been as to a rhino having been born here ten years ago (in 1928), no one has, to my knowledge, offered evidence to suggest that one has been born since that time. I am quite aware that criticism is useless unless it can also be constructive. I have assumed that if further investigation proves it necessary, steps will be taken to render possible the procreation of these animals and as I contend that their species has not definitely been proved beyond question that is the first object to be undertaken. Having proved that the animals are *sondaicus* as I fervently hope may be done, it is then, useless to ask *how* much can, or will be done by the Government. It is not, unfortunately, a question admitting of bargaining or compromise. The irreducible and minimum reforms necessary must first be recognized as essential, and unless those can in one way or other, be immediately effected, it is a waste of time attempting anything, for if these few pathetic remnants persistently referred to by the writer of one report, as a 'herd', are proved to be of the Javan species and to contain among them a virile male and female, then immediate and drastic steps must be taken to provide the necessary opportunity for breeding. The first step undoubtedly will be to stop all cultivation, whatever in that portion of the Sanctuary *in which, the rhino find it necessary*, or are at all likely to go, and secondly and of equal importance is it that the entrance or passage of any natives or dogs whatever is not merely prohibited, but absolutely *prevented.* These minimum conditions being found impossible to effect or having been effected, are found eventually not to have been successful in their object, then in the interests of science it would be better to effectually secure their pitiful carcases, for posterity, not as technical exhibits alone, but as monuments to the apathy, ignorance and ineffectiveness of our legislators.

REVIEWS.

I.—ANNUAL REPORT ON GAME PRESERVATION IN BURMA FOR THE YEAR ENDED 31st MARCH 1938.

The 'Annual Report on Game Preservation in Burma' for the year which ended on 31st March 1938 gives us little information about practical Game Preservation. The reason is not far to seek. The Burma Government vote inadequate supplies from the large forest revenue for this service.

We read on the first page of six areas aggregating 542 square miles, nearly 350,000 acres, containing a formidable list of species to be preserved—that we may presume was the object in creating these sanctuaries—, but when we turn over the page we find that only two of these sanctuaries have guards attached to them, and then only a total of eight, six in the Pidaung Sanctuary and two in the Kahilu Sanctuary.

In these areas there were two cases of poaching discovered in the Pidaung Sanctuary and none in the others. As four of them appear to have looked after themselves this is not surprising.

In paragraph 8 we are informed that 'From reports of the keepers the stock of animals appears to be increasing steadily', in the Pidaung Sanctury. One bison herd of 106 animals was reported, and the Game Warden himself obtained a close-up view of another herd containing 52 animals. The counting of a herd of wild animals, always moving, always restless, is a very difficult and exacting business, and only figures obtained by trained observers, such as the Game Warden himself, can be considered as reliable.

In paragraph 9, bison and *saing* are referred to as 'rutting' in April, but the *Bovidae* do not rut in the meaning of the word as applied to the *Cervidae*. With bison and *saing* the females come into season not the males, and although the reasons for the urge are somewhat obscure it is probably governed by conditions of feeding rather than by conditions of weather due to seasonal changes.

Mention is made of the probability of any very old bison being killed by tiger or panther. It would be interesting to know of any reliable records of panthers killing bison.

In several places in this report it is suggested that action might be advisable to reduce tiger in sanctuaries. The very name 'Sanctuary' implies a refuge for all wild life and in the early stages of conservation of wild life as pertains at present in Burma such mistakes should be avoided.

In paragraph 12 the Kahilu Sanctuary is referred to as having as its sole object the preservation of *Rhinoceros sondaicus,* and it is recorded that during the year a calf was born, bringing the total up to seven specimens.

These statements are based on the reports of the ranger-in-charge of the sanctuary and no expert examination was made by the Game Warden.

I have recently seen a report made by an entirely independent observer, well qualified to explore the area and examine the evidence, and it is extremely doubtful if there are anything like seven *sondaicus* in this sanctuary. The statement that a calf was born during the year was not supported by any reliable evidence obtained by the investigator I refer to.

As his report is published in this issue it is unnecessary for me to refer to the matter further.

In paragraph 16, sanctuaries are proposed for *thamin,* the Brow-antlered Deer, in the Shwebo Division, which it is hoped will be constituted during the coming year.

This rare and striking deer has been persecuted to such an extent in Burma that it is on the verge of extermination, and as the Game Warden writes, 'There is little doubt that the continued existence of this deer will depend on the protection afforded by sanctuaries'.

In paragraph 24, referring again to the Kahilu Sanctuary, it is stated that it is believed the *Rhinoceros sondaicus* in this area are the only recognized survivors of this species in the world. This is incorrect because they undoubtedly exist in Java and Sumatra.

In Chapter II reference is made to the wild life in forests other than Sanctuaries.

The question of proper control of the work of wild life preservation is briefly referred to and it is clearly indicated that a system by which the care of the fauna has to be entrusted to those who have full time-work as Forest Officers is unsatisfactory and can never mean efficient protection for wild life.

It is difficult to understand the reference to the case mentioned in paragraph 36 of shooting a male bison being prosecuted in a civil court. Surely poaching is a criminal offence in Burma?

Mention is made in paragraphs 39, 40, and 43, that wild dogs are on the increase.

It is possible that wild dogs have a period during which they progressively increase and then due to some unknown reason become scarce, again increasing until some unknown peak is reached. This phenomenon is well recognized amongst some species, the Ptarmigan in Alaska being a striking example. It is Nature's way of adjustment and something of this sort may operate to keep wild dogs within reasonable limits.

In paragraph 41 surprise is expressed at the reported disappearance of game in the Tharrawaddy Division.

Until there is an adequate staff for the purpose of wild life conservation answers will never be found to these queries.

The control of elephants, which is an important activity of the Game Warden, does not provide very exhilarating reading in a Game Preservation Report.

We are told that 711 elephants were removed from the forests of which 543 were killed or found dead. We are also told that the removal of 711 elephants from the forests probably slightly exceeds the annual natural increment. No reasons are given for this statement and it would be interesting to know on what statistics it was based. With the inadequate arrangements for guarding the fauna of Burma, it is somewhat astonishing to hear even a tentative figure mentioned in connection with the annual increase of calves which can only be ascertained after much observation and hard work.

Although a Wild Life Protection Act was passed in 1936, Rules had not been issued up to March 1938. As is so common in present-day legislation many important items have to be dealt with by the Rules, and it is surprising that the obligations that the legislators have placed on the Local Government have not been attended to! So the Game Rules of 1927 are still being followed where they do not conflict with the provisions of the new Act.

Paragraph 53 pleads for a better organization to deal with the preservation of the wild life of Burma, a very necessary and urgent matter if conservation is to be taken seriously and placed on a proper footing.

Chapter III deals exclusively with the control of firearms and ammunition and in studying this chapter it is easy to understand how unsatisfactory the position must be from the Game Warden's point of view.

The exploitation of the Fauna supplies the theme for Chapter VI. It calls for no special comment.

In Chapter VII the last paragraph contains a significant statement. It is:—'. . . although sambhur and hog-deer may now be shot outside reserves irrespective of sex and without game licences. . . . '

It is astonishing that such game animals as sambhur and hog-deer may be shot outside reserves without any restrictions and is a sad reflection on the mediæval ideas of Burma on the value of such forms of wild life.

Paragraph 75 contains some alleged particulars of an animal not yet identified. If the other particulars are as valuable as the remark that it is 'apt to attack on sight' they are not worth considering.

Chapter IX, 'Financial Results', does not make inspiring reading.

Under expenditure the biggest item is for elephant control, which means largely the destruction of elephants. There is no item at all for Rangers employed solely on Wild Life Conservation, outside the Sanctuaries, although 19 Game Rangers were employed to destroy.

Part IV refers to the Federated Shan States.

In paragraph 86 we are told that in these States there are two sanctuaries, Shwe-u-daung in Mongmit, comprising an area of 45 square miles, and Taunggyi Fuel Reserve North Block, in the Southern Shan States, comprising an area of 6½ square miles. The former marches with the Shwe-u-daung Sanctuary in East Katha, Burma, making a compact block of 126 square miles.

No special staff guards these sanctuaries.

It is proposed to exploit teak in the Shwe-u-daung Sanctuary, and as this area is supposed to contain *Dicerorhinus sumatrensis* one can imagine the result? The Sumatran rhinoceros will neither breed nor remain in a disturbed area. When will the Government of Burma appreciate the fact that wild life conservation and commercialism do not make happy bed-fellows. If commercialism is to take precedence of other considerations then it would be better to state clearly that wild life conservation is not a vital issue or even an important activity but that a little temporary window-dressing may be desirable at times.

After reading this report one is bound to feel sympathy with the Game Warden in having to make his bricks without straw. No successful conservation of the fauna, except possibly in a favoured site such as the Pidaung Sanctuary, appears to be possible under the unfortunate conditions which obtain.

If Burma really wants to preserve its wild life then it should organize a proper department to do so and should try to follow the lines adopted in North America where in many parts the work of conservation of the wild creatures of the plains, the forests and the streams has been successfully organized and is efficiently executed.

THEODORE HUBBACK.

II.—THE FORMENKREIS THEORY AND THE PROGRESS OF THE ORGANIC WORLD, by O. Kleinschmidt. Translated by F. C. R. Jourdain. Pp. 192. *London* : H. F. & G. Witherby.

This translation was first published in 1930. The book under review appears with the author's preface of 1926; and the author's note to the English translation is dated 1930.

The author's aim is to explain the nature of the Formenkreis Theory, which, in his opinion, is the key to the right interpretation of Evolution and Raciology. With this end in view he begins by exposing all that is erroneous in the old theory of Evolution. He then disposes of the biased objections to the Formenkreis Theory, and thus clears the ground for a full statement of his doctrine, which he does in a manner that leaves no doubt as to what he holds.

The one drawback, however, is in the understanding of the very phrase 'Formenkreis'. 'Formenkreis is the true *Real species* of the philosopher Kant, not the *Species* of Linné, not the *Species* of Darwin, not the *Species* of my friend Dr. Hartert, and other English, German, or American zoologists, not the *Formenkreis* of Tschulok, nor the *Rassenkreis of Rensch* (Author's note).

J. F. C.

III.—A GUIDE TO THE SNAKES OF UGANDA, by C. R. S. Pitman. Pp. xxi+362. The Uganda Society, Kampala, Uganda; 1938—London: Simpkin Marshall, Ltd., 1939. Price 30/— net.

Captain Pitman is an enthusiast who has put a great deal of work into this book, which should stimulate the study of the snakes of Uganda.

As he is already well known for his capacity for collecting and recording information, and as he is equally experienced in field work, the author has on the whole attained his threefold object: to afford a descriptive list of the known species and make their identification easy, to provide a better understanding of snakes generally, and to draw attention to their very definite role of benefactors to humanity. But to attempt to include so much, combined with the author's somewhat drab style, tends to make the book rather confused and unsatisfactory reading.

As a faunistic work the book is undeniably of the greatest value. It is moreover generously illustrated with abundant line drawings and coloured plates, some of them excellent. These and other unquestionably good points must induce a lenient view of the many shortcomings in the matter of clarity and presentation.

J. F. C.

IV.—MEDICAL ENTOMOLOGY: *A survey of insects and allied forms which affect the health of man and animals*, by W. A. Riley and O. A. Johannsen. Pp. xiii+483. New York and London: Mc Graw-Hill Book Company, Inc.; 1938.

This is the second edition of a book published in 1932, which was, itself, a revision of the authors' justly appreciated 'Handbook of Medical Entomology'. The present text is excellent and up-to-date, and the bibliography, though incomplete, is valuable. It will be of great assistance to doctors and senior medical students.

J. F. C.

MISCELLANEOUS NOTES.

I.—BEHAVIOUR OF MONKEYS WHEN ATTACKED.

The letter of the heir-apparent of Malerkotta State on the above subject draws attention to the extraordinary behaviour of monkeys, which I can confirm. On several occasions when attacked by leopards, and on numerous occasions when attacked by dogs, which of course cannot climb, I have known them to abandon safety in the tree tops, and taking to earth, get destroyed. In this respect, an animal which must be considered intelligent, behaves as an imbecile. A fuller account of this habit will be found on pages 137 and 138 of *Wild Animals in Central India,* this being so far as I know, the first occasion on which the phenomenon was referred to. The letter under discussion, of course confirms, what I wrote in 1923. The observations of others would be of interest, as more enlightenment is required on such very peculiar behaviour.

February 6, 1939. A. A. DUNBAR BRANDER.

II.—OCCURRENCE OF TIGER IN SIKKIM.

In view of the report in the December 1938 issue of the *Journal* by Lt.-Colonel F. H. Lister to the effect that he had come across a fresh tiger skin at Lachung, North Sikkim, last April, it may be of interest to record that in 1934 a tiger killed a mule at a place called La Gyap (11,500 ft.) on the road between Gangtok and the Nathu La pass. The late Mr. F. Williamson, then Political Officer in Sikkim, sat up for the tiger and actually saw it, though he was unsuccessful in his attempt to shoot it. It would be interesting to know the maximum height above sea level at which tigers have previously been known to occur.

At this place, La Gyap, the country is very steep and mountainous and the jungle consists chiefly of bamboos and giant rhododendrons. Apart from the one transport mule killed, it is difficult to suggest what might have been the tiger's fare; though there is an abundance of bird life in these precipitous jungles neither pig nor barking deer, common lower down, occur, while monkeys would probably be safe from a tiger. Had the tiger taken up his permanent abode in this locality it is not unlikely that he would have been faced with the problem of killing serow, goral or musk deer on their own pretty difficult ground. There can be little doubt however that this particular tiger was a pioneer explorer and probably returned to lower levels after being shot at. There is another alternative, though it is one which I hesitate to suggest, it is that he may have gone on over the Nathu La pass (14,300 ft.) and into the Chumbi valley! Colour is lent to this suggestion when it is remembered that some time later a large domestic bull yak was found here killed yet uneaten, with fang marks in his throat, though at the time, this tragedy was thought by the owner of the yak to have been the work of an 'abominable snow man' or 'mirka'.

GILGIT. R. K. M. BATTYE,
January 14, 1939. *Captain.*

III.—OCCURRENCE OF TIGER IN SIKKIM.

In connection with Colonel Lister's note of the appearance of a tiger in North Sikkim, the following may be of interest:—

A tiger was reported to be killing ponies and yaks in the neighbourhood of Karponang, the first rest house on the road between Gangtok and the Nathu La. I actually saw the pug marks where the animal had jumped up the steep bank of a road cutting. One evening it was reported that two ponies had been killed. I went out at once but found the owners were already engaged in skinning the animals. I put the skin back roughly and sat among some rocks from about 8 p.m. till 11. The tiger did not appear so I returned to Gangtok. The owners of the ponies went again at daybreak to finish skinning them and found the tiger on the kills. They reported that the tiger growled at them and they fled. I went out and beat for him and he was seen by the beaters but no one had a shot. All this occurred at about 9,000 feet. The tiger then crossed the Lagyap La, 11,000 ft. and reports of kills were brought in on several occasions. It finally reached Changu lake at 12,600 ft. where on 19th June 1924 it killed a yak. I myself saw this yak and judging by the distance between the tooth marks I am convinced it had been killed by a tiger.

The animal had been driven off before he commenced to eat and the ground round the dead yak was so trampled by the yak-herds that no pug marks could be found. The tiger then crossed the ridge, about 13,000 ft. above sea level into the valley of the Yelli Chu. From here it crossed another ridge into the valley of the Dikchu where it was killed at a comparatively low elevation. It will be noticed that this tiger was never seen (except by yak-herds and a beater) at any high elevation, but the total evidence that he actually travelled the road and passed the heights indicated is in my opinion convincing.

F. M. BAILEY,
Lieut.-Col.

EGMERE,
WALSINGHAM,
NORFOLK.
February 13, 1939.

IV.—UNUSUAL BEHAVIOUR OF PANTHERS AND TIGERS.

A Planter friend in the Travancore Hills, Mr. M. R. Coghlan, writes to me that one evening in January 1939 when returning after dark from the Vandiperiyar Club in his car there, on rounding a bend, headlights on, a fine panther was seen to be walking along. The car stopped, so did the panther. He sat on the crown of the road facing the headlights, and about 20 yards away. His mate, presumably, with a very young cub, joined him from among the roadside bushes, and all three sat on the road, baby in the centre, gazing at the lights. A delightful scene, but nothing very unusual.

The three were joined by a half-grown panther, presumably of a former litter, and the four of them sat together until some estate coolies coming from the opposite direction caused them to move into the bushes.

This association of a half-grown animal with the very small cub of a later litter and its parents is an occurrence not within my own experience; and in the fifty odd years of the *Journal* of our Society there is no record of such a thing having been seen. Perhaps one of our members may be able to cite something of the kind.

There is an unusual incident from the same locality in regard to a tiger. On Mr. H. Gibbon's Tea Estate a large tiger broke into the cowshed early one morning and killed thirteen cows and calves. I have a copy of a photograph showing eleven of the poor creatures lying at their tethering pegs.

A few days later this same tiger killed a bullock on the Estate and was shot at sundown by Mr. Gibbon. It was a large tiger, measuring 9 feet 7 inches.

I have personal knowledge of a panther in the Chratrata Hills having slain 33 sheep at one killing in the lower storey of a house when the owners were away, and of a tiger having killed five tethered baits one stormy night in the Godavery jungles, but in the fifty years of the *Journal* there is no record of such wanton slaughter as this; neither can I recollect having read of such a happening in any natural history or shikar book.

Can any member record anything to equal it?

COONOOR. R. W. BURTON,
February 13, 1939. *Lt.-Col.*,
Indian Army (*Retd.*)

V.—A COIN LODGED IN A TIGER'S PALATE.

I thought it might interest the Society to hear that in January this year, I shot a tigress in which was found a coin, when it was skinned the next day.

I shot the tigress on the 3rd January at 1-15 a.m. over a kill near Umarti, a village in West Khandesh. The tigress had killed a bullock, a tie up, the previous night; we had a beat for her the next afternoon, which was unsuccessful. As the tigress had not been seen in the beat, I decided to sit up for her that evening over the kill, and she duly came straight to the remains at 1-15 a.m. next morning.

The tigress was skinned the next day and the skinner, on boiling out the head, found a coin between the skin of the roof of the mouth and the palate. The coin was an 1877 piece, the head side of the coin which was against the skull, being rather scratched.

A coin lodged in a tiger's palate.

I enclose a photograph of the skull, which clearly shows the coin in the roof of the mouth. I am sending you the coin and also a photograph of the tigress, before being skinned.

The most obvious theory as to how the coin got into the skull, is that the tigress was a maneater, but I think that that is definitely disproved by the fact that she went straight up to her kill of the previous night and also the forest people had no reports of a maneater in that area. There were, also, no marks on the skin, which disposed of the theory that some villager had fired at the tigress with some ancient weapon, and had put in a coin, as luck, to help his aim. I thought that these were the two most obvious theories, of what I imagine must be a very uncommon occurrence. But I think both are wrong in this case; so I thought that possibly you would care to get some answers on the subject.

GOVERNMENT HOUSE, D. CHETWODE,
BOMBAY. *Captain.*
February 24, 1939.

VI.—EFFECTS OF MAULING BY TIGER.

Maulings.—At the time of my accident I wrote to the *Field* mentioning the fact that maulings, so far as I was concerned, were nearly painless. No comments were made on this particular point so I would like to bring the subject up again in this country where accidents of this nature are more prevalent than at home.

My friend and I had wounded a tigress who retired to long grass and lay completely invisible except to one of the stops in a high Sal tree. The first branch of this tree was some 25 feet from the ground and I attempted to swarm this tree with a view to finish her off from the safety of the first branch. My friend meanwhile stood within a few feet of the foot of the tree. I had arrived within a foot or so of my objective, some 20 feet from the ground, when the tigress charged. My friend fired but missed. The tigress completely disregarding the person on the ground, within a few feet of her, proceeded to scramble up the tree. I could hear her climbing and tried to get a view of her which I finally managed to do coming up under my right leg. Forgetting my friend on the ground, I kicked out at her as she came and managed to get her on the nose, almost dislodging myself in doing so as I was only hanging on with my arms which were wrapped round the bole of the tree. The tigress however did not release her hold on the tree but seized my foot in her mouth; she very soon let go, but as I was trying to recover my grip on the tree, she seized my right leg, mid-way between the ankle and the knee.

My friend owing to the sharp angle from which he had to shoot, had walked back a few paces and proceeded to open fire. He put five shots into her before she fell. Unfortunately she forgot to open her mouth when we parted, and in falling ripped muscle and bone from the leg.

When I was sure she was dead I climbed down, by this time feeling fairly faint, mainly from want of breath. I was finding it extremely hard to fill my lungs and appeared only to be partially able to do so.

However this was soon put right by our Baiga Shikari, who waved some branches of a particular shrub in front of my face.

I had felt no pain from start to finish, yet had felt the blood trickling down the side of my leg. I was also stone deaf and did not even hear the five shots fired by my friend at some few yards range and in my direction. About an hour and a half later, when we applied permanganate of potash, I felt extreme pain but this wore off in a very short time and I felt nothing except a faint kind of numb ache, until I arrived in hospital some 10 hours later and the wounds were being probed and cleaned.

The interesting questions which emerge are these:—

1. Had the tigress' attack come without any warning, would I have felt more pain?

2. Was it because I had ample time to realise what was going to happen that my nervous system was prepared to receive the shock?

3. Would this be applicable to an animal either wounded by a bullet or by another animal?

4. It is common knowledge that should an animal be only wounded with the first shot, all subsequent shots appear ineffective, unless vital. Is this because they feel no pain after impact of the first shot?

The views of any one else who has been mauled would contribute to our knowledge on this interesting subject and I hope you will find space to publish at least some of what I have written as I feel sure that this topic would be of more than general interest.

4 Alipore Road, H. A. FOOKS.
Calcutta.
February 4, 1939.

VII.—HYAENAS ATTACKING HUMAN BEINGS.

Having been out of India since March 1936, I have only now come across references in articles contributed by Mr. S. H. Prater regarding man-killing hyaenas in India, so give an instance which came to my notice in 1907 when stationed at Nowgong, Central India.

On the 13th March 1907, I received information from the village of Ajnar, 12 miles to the north of Nowgong that an old woman had been killed by a wild beast. I went next day to the village and found that an old woman—Mussumat Jhunari had been sleeping on the ground in a field near the village on the night of the 23rd February and been killed, dragged off, and mostly eaten. A boy had been killed and eaten 4 months previously 5 miles away.

On the 17th March a woman, Mussumat Gori Doolan, aged 50 was seized by the head near the village while sleeping in the open. The beast let go. On the 19th March a tethered goat was killed but the carcase not touched on the two following nights. On the 23rd I went to the village and sat in a grave-like excavation with a cart frame placed on top and covered over with thorns. At 3 a.m. a stone chinked on the hill side and soon after a beast came with a rush and seized the goat. The moon had gone down. I fired the right barrel of my 12 gauge gun loaded with Meade's shell and followed this up with the left barrel loaded with SSG. A gurgling and gasping was heard and field-glasses showed some large creature was down.

At daybreak I found the animal killed to be a female Hyaena with Meade's shell in the back of its head. The gurgling noises had been from the goat which had been seized by the head and had the top of its skull almost torn off.

The hyaena was a large one and in milk. I heard stones chinking on the hill side after the shots were fired and have no doubt there were young ones with her.

I examined Gori Doolan's head and found two fang holes and sundry abrasions and have no doubt that she was attacked by the hyaena.

After this hyaena was killed there were no further casualties by wild beasts in the neighbourhood.

COONOOR, R. W. BURTON, I.A. (*Retd.*),
January 23, 1939. *Lt.-Col.*

VIII.—NUMBER OF YOUNG HEDGEHOGS HAVE AT A BIRTH.

Referring to my note 'Notes on Hardwicke's Hedgehog (*Hemiechinus collaris* Gray and Hardw.)', published in volume xxxix, p. 616, regarding the number of young hedgehogs have at a birth, it seems quite clear from a photograph published in the September issue (1938) of *The Field*, p. 572, that hedgehogs *do* have more than a single young at a birth. In the photograph referred to taken by Dr. Swaine there are three young to be seen with the mother. There is no reason whatsoever, why Indian hedgehogs should differ from European ones in this regard. Accordingly we must accept Dobson's statement (*F.B.I.*, Mammalia, p. 214) 'the number of young at a birth never exceed' four. An explanation of my observation may be that not all the foetuses were discharged from each female.

BOMBAY NATURAL HISTORY SOCIETY, C. McCANN.
BOMBAY.
August 23, 1938.

IX.—WEIGHT OF TUSKS OF THE INDIAN ELEPHANT.

Will you kindly let me know the weight of the largest pair of elephant tusks recorded in Assam? I have just shot an extremely large solitary elephant carrying tusks of 7 ft. and 7 ft. 1 in. weighing 115½ lbs. The tusks are perfectly symmetrical and converge towards the extremities leaving a distance of only 4 in. between the points, making it impossible for the elephant to raise his trunk between them.

I have taken photos of this elephant and if it would be of interest to readers will be pleased to send them to you for publication. You may recollect that last year I sent you photos of a most unusual tusker which you were kind enough to publish in your journal.

I am writing to you because it occurs to me that the weight and length of these tusks may constitute a record for Assam.

THE KACHARI GAON TEA CO., LTD., G. D. L. MILLAR.
TEZPUR, ASSAM.
January 4, 1939.

[The heaviest recorded tusks of the Indian Elephant is a pair in the possession of H.M. The King:—Length 8′ 9″; and 8′ 6½″; weight 161 and 160 lbs. The animal was shot in the Terai. The record for Assam is a pair of tusks in the possession of the Earl of Lytton:—Length 8′ 9″ and 8′ 2″; weight 81 and 80.2 lbs. (Rowland Ward, *Records of Big Game*, 8th Edn.).—EDS.]

X.—BEHAVIOUR OF SAMBHUR IN THE PRESENCE OF WILD DOGS.

It was very interesting to see the reaction of sambhur deer to the presence in the locality of wild dogs. One afternoon when I was in the lick a male barking deer or *kijang* was killed by wild dogs about half a mile up river from my camp and about a mile and a half from the lick. I had, on a previous occasion, seen wild dogs actually in the lick ranging for tracks. A day or two after the killing of the *kijang*, a young spike buck sambhur deer came to the edge of the lick. This was at 11 a.m. It messed about just on the fringe of the jungle for three quarters of an hour before it would venture into the lick. The way it tested the wind was wonderful, and the positions it got its ears into were astonishing. On another day a young sambhur, sex undetermined, came to the edge of the lick but never went in at all. But three sambhur —separate ones—came into the lick at night and had a good drink and were evidently there for some time, no doubt knowing that they were safe from wild dogs at night.

I have seen hundreds of sambhur approach and enter salt-licks but have never seen them as cautious as the one I mentioned above.

SUNLAWS,
BUKIT BETONG,
KUALA LIPIS, T. R. HUBBACK.
PAHANG, F.M.S.
March 1, 1939.

XI.—THE PUNJAB SIRKEER CUCKOO [*TACCOCUA LESCHENAULTII SIRKEE* (GRAY)] IN SIND.

In the Honorary Secretary's report for the year 1937 (vol. xl, No. 2, September 1938) interesting reference is made to the effect of the Sukkur Barrage and its perennial Canals on the bird life of Sind.

Another species which now appears to be establishing itself and extending its range in the Province is the Sirkeer Cuckoo.

Prior to the Barrage (1932) the Sirkeer was almost unknown. Dr. Ticehurst, in his *Birds of Sind,* shows that one was obtained in Sind by Doig, and one on the Baluchi frontier by Blanford, but goes on to say that no other records exist and that its status is doubtful.

I first saw a Sirkeer in August 1933 at Katiar, a village on the Indus about 25 miles south of Hyderabad.

After that I did not come across another either in Lower or Upper Sind until I was transferred to the Hala Division in December 1937.

Between December 1937 and February 1938 we occasionally flushed one while shooting partridge in cotton fields some 20 miles north of Hyderabad in the vicinity of Oderolal and Matiari (Hyderabad District).

In roughly the same area I saw one on 1st July 1938, and one on 15th August, 1938.

By the shooting season October 1938 to February 1939, the number of Sirkeers seemed to have increased, and we frequently drove one out in this same locality when shooting partridge in the cotton fields.

On 5th January 1939, one was put up during a partridge shoot in the Nawabshah District, a few miles west of Shahdadpur.

This is the most northerly point at which I have come across it.

The bird usually skulks in cover, or on the ground at the side of cover into which it dives if disturbed.

Its flight is feeble, and it is not flushed until nearly trodden on.

Only once, on 13th February 1939 in Matiari P.W.D. Bungalow compound, have I seen it in a tree.

Although not yet found breeding by me, as Dr. Ticehurst says, this bird is probably resident where it occurs.

HYDERABAD (SIND). N. H. MENESSE,
March 29, 1939. I.S.E.

XII.—LEECHES ATTACKING CHICKS OF THE PIED KINGFISHER (*CERYLE RUDIS* LINN.).

It might be of interest to record that a half-fledged pied kingfisher (*Ceryle rudis*), taken from a nest at Poona last Sunday, had several well-gorged leeches hanging on to various parts of its body.

Another interesting point raised was that the chick could (or would?) only move backwards. The possibility of this trait being more prevalent among other hole-breeders has already been touched upon (*J.B.N.H.S.*, xl, p. 171), and further notes and observations on this subject would be of interest.

ANDHERI. HUMAYUN ABDULALI.
March 24, 1939.

XIII.—BREEDING OF THE INDIAN BARN OWL [*TYTO ALBA JAVANICA* (GMELIN)] IN BHAVNAGAR.

In Ambla village, in an orchard of old mango trees stood a 50 foot *Jambuda* tree, the trunk was thick at the base and the branches well leaved on all sides. The main stem had been burnt hollow from the top downwards for about 10 to 12′ at the centre. A native trying to smoke a beehive had set the tree on fire. Inside the cavity was the nest of the Indian Barn Owl (*Tyto alba javanica*), four young barn owls were pulled out, the youngest had still some downy feathers remaining while the other three were yet unable to fly although fully fledged. The nestlings when irritated gave out prolonged hisses much like the hissing of a large snake.

The eggs must have been laid during the first week of October and the parents had found it easier to rear the young when the field mice were in plenty in the standing crops.

BHAVNAGAR. K. S. DHARMAKUMARSINHJI.

November 19, 1938.

XIV.—THE INDIAN GREAT HORNED OWL [*BUBO BUBO BENGALENSIS* (FRANKL.)].

This morning to my delight I received news from my *shikari* of the nest and eggs of the Indian Great Horned Owl (*B. b. bengalensis*), a bird seldom seen at day and not found commonly in these parts of Western India. We motored to the hills a distance of approximately seven miles from Bhavnagar, which are now partly grazed and denuded of long grass. The hills are not higher than 250 to 350 feet in elevation and as you progress the chain becomes wider and the hill tops numerous.

The actual nest, which can hardly be called more than a scraping in the earth, was under the shelter of three black, superposed rocks; while on one side, were two small stones of the same type which formed a screen against the evening sun. The nest cavity was fairly large but not deep. The situation of the nest was half way up the sloping side of a hill and facing North. The site must have been selected so as to protect the eggs from direct sunlight. The country round about is studded with Khakhra (*Butea frondosa*) and Gorad trees of small size, the former more profuse, there are cactus clumps to be seen. While the two sides of the particular ravine showed numerous outcroppings of black rocks.

From across the ravine we sat and watched the parent owl brooding with half-closed eyes, gazing at us now and then. The sun was high but the overhanging rock sufficiently shaded the nest.

I tried to approach the nest by walking nearer but when about 10 feet away, the bird took alarm and flew away, but not going far, alighted amongst some rocks. I then saw the four white spherical eggs, one of which was slightly soiled with a blood stain. The hollow in which they were deposited was natural, there were three castings two of them I recognized to be gerbilles. I took a few photographs and then waited for half an hour for the bird to return but was disappointed.

22nd December.—Saw the first young owl, the mother flew away leaving the two white eggs and her naked, newly hatched chick. One egg was missing and there was no trace of it. How and by whom was it removed so carefully I wonder ! The young in down had its eyes closed and its pink skin showed wherever the pure white fluffy down was wanting.

27th December.—As expected, all three young owls had hatched and were growing rapidly. On this occasion I met with the male bird which seemed decidedly smaller in size than the female. Moreover, he never called like the female but watched me from the top end of the ravine. The female, even though it was 12 o'clock in the morning, called once or twice in a very irritated manner and then flew away as I came close to her. I spent the day watching the birds as I had read that the Great Rock Owl was a diurnal feeder. But during all my visits and observations never did I once notice the owl feed at day time.

4th January.—Just before sundown I visited the nest again with the three little baby owls in their soft smoky grey down. As I approached, the parent bird flew a little way off and feigned to be wounded. Coming to ground she began flapping her wings from side to side on the ground and at the same time squealing. I had seen similar performances by other birds, but this experience with a Great Owl was astounding. Having had a look at the young, I moved towards the greatly worried bird, she let me approach to about 60 feet and then flew away. I waited to see whether feeding would commence so sat down behind a bush. After sundown, as the moon rose, I could in the silence clearly hear the young owls chattering in hunger. The mother bird now flew back and perched on a rock higher up the hill and in a second began to hoot. The hoot was a double note, *whooo-whooo*, which went echoing into the hills. She emitted this call every half minute. Then behind me and behind the hill I heard a new sound which proved to be that of the male. He did not see me and flew up to the nest, and spying me immediately flew off and circling round, settled about forty feet away with his horns erect. Then he gave out a few growls and the next moment the female arrived and commenced hooting again, but this time she gave out another sound —a note of three syllables which sounded very weird and ominous. I tried to see whether they would leave to procure food for the young, but the male which was more quiet flew away, while the female kept a very scrupulous guard upon me and followed me until I left the hills.

6th January.—Today I was out exploring the grassy hills endeavouring to shoot some Nilgai, as they had increased enormously and were causing damage to the neighbouring village farms. After having reduced their number by half a dozen I met a grass cutter, who on enquiry told me that he had seen a nest of a Great Horned Owl with two young about ten days before. He led me to and showed me the nest. It was situated on the side of a hill, with a ravine below and much resembled the first nest I had seen, except that this was a scraping in the long grass and was not under any stone. Above it was a small thorny shrub and in front a *Khakhra* bush. The nest was facing north like the other nest, there were no rocks on that particular side of the hill but across the ravine there were many. With close observation one could distinctly see the white mutings of the parent birds on the black boulders. The sole and only nestling that occupied the nest was not at all aggressive nor did it hiss when I picked it up. It had vermicellated markings on its downy feathers. There was no trace of the second young as mentioned by the grass cutter. The white mutings near the nest were conspicuous and I also found the feathers of Quail, Painted Partridge and Common Partridge which had evidently been killed to feed the young. There were no castings or remains of other food mater. I was surprised not to see the parent birds which are usually much on the *qui vive*, but I presume that the fledgeling was large enough to leave the nest soon, the parents did not take the same keen interest in guarding it. The young bird's eyes were precisely the same colour as the adult bird and the down feathers browny-grey.

12th January.—A party of friends and myself decided to take the parent birds and the nestlings for the Museum. We obtained both the male and female. To our surprise and disappointment we only saw two young owls in the nest one of which was stone dead, the other seemed to be drooping. What had become of the third nestling? It was the same mystery as in the case of the fourth egg. The thought brought me back to the second nest, where there had been two young and now there was only one. Does the Great Horned Owl only feed one and leave the rest to die? or was there less food. There was plenty of game in the close vicinity and as I searched the nest, I found Painted Partridge, Common Partridge and egret feathers as well as hare fur; this evidence convinced me that the supply was ample. Then what could have happened to the young?

In front of the nest were scattered white mutings and a leg and feathers of a Partridge. The young owl when disturbed snapped causing a click made by the friction of the upper and lower mandibles. This click sounds like a hard nut being cracked. The sound is much more audible in the adult birds generally emitted in anger and defence.

CONCLUSION.

1. The male in size is decidedly smaller than the female.
2. Both male and female share in rearing the young guarding the nest.

3. The Great Horned Owl may feign injury to divert attention from its nest.

4. This Owl is not a diurnal feeder.

5. It does some damage to game and also kills water birds and at the same time destroys harmful mammals.

6. The call varies from squeals and growls to resounding hoots. It even hoots in broad daylight especially when there is a nest.

BHAVNAGAR. K. S. DHARMAKUMARSINHJI.
January 19, 1939.

XV.—THE INDIAN CRESTED SERPENT EAGLE [*SPILORNIS CHEELA CHEELA* (LATH.)].

At 7-30 a.m. in the morning I took a drive in the park alone intending to take some photographs of Nilgai. When nearing a familiar bridge, I perceived in front of me two smallish eagles perched on a *Neem* tree. I stopped the car at about twenty yards distance, and at a glance I recognized one of the birds to be a Tawny Eagle, whereas the second slightly larger bird was, a species I had never seen before in these districts. It had a black crest, golden yellow eyes and body of fulvous colour with white spots on the flanks. It sat very upright and seemed to have long legs. I was getting ready to take a picture when another car drove opposite me and passing the tree scared away, first the tawny eagle, and then the newcomer, which, without much agitation, flew towards me and sat in a clump of thickly interlaced trees. This brought the bird much closer to about 20 feet. I took two snaps before it flew away. The bird was later shot for me by a shikari and proved to be an Indian Crested Serpent-Eagle which I do not believe has ever been recorded in Kathiawar.

BHAVNAGAR. K. S. DHARMAKUMARSINHJI.
November 22, 1938.

XVI.—DEATH OF A CURASSOW (*CRAX* SP.) CAUSED BY CONGESTION OF THE OVIDUCT.

On the 19th May 1939, Mr. Ahamadi, the Superintendent of the Victoria Gardens, Bombay, sent the Society the carcase of a Curassow which had died in the Gardens. It was made over to the skinner for disposal. Some time later the skinner returned with a full term egg which he had found in the bird. As the egg was badly stained black, I was anxious to discover the reason for the peculiar colouration, which was undoubtedly a sign of decomposition; so I carefully examined the specimen. The egg was an old one. On blowing it out the contents appeared stale and smelly. The bird, either could not void the egg, or was disinclined to lay it, when mature, owing to uncongenial surroundings. Whatever the reason the egg remained in the oviduct, not only obstructing it, but also causing an obstruction to the alimentary canal against which it was pressing. In due course decomposition must have set up, and the discolouration of the egg was undoubtedly due to its products, as the egg is very deeply stained and no amount of washing will remove the stain. The intestines were affected by the putrefaction going on within, and were bloated with gas. The death of the bird was undoubtedly due to the congestion caused by the presence of the egg.

BOMBAY NATURAL HISTORY SOCIETY C. McCANN.
BOMBAY.
May 20, 1939.

XVII.—SUPPOSED BREEDING OF PINTAIL SNIPE [*CAPELLA STENURA* (BONAPARTE)] IN BELGAUM DISTRICT.

With reference to the note by Mr. O. H. de St. Croix on p. 571 of vol. xl of our *Journal* I write to say that it is exceedingly unlikely that the Pintail Snipe should breed in the Belgaum district. May 5th is admittedly a late date for this species to be found in the plains but it can be paralleled. William Davison, for instance, met the Pintail Snipe in the Wynaad on 5 May (*S.F.*, x, 413) and substantiated his record by shooting a specimen.

As to the nests described by Mr. De St. Croix's local informants these were very likely those of the Painted Snipe. The site—in the large grass on the bunds of rice fields—is in accordance with Butler's description in Hume and Marshall, iii, 387 and July is an appropriate month.

CALDBEE HOUSE, HUGH WHISTLER.
BATTLE-SUSSEX.
April 4, 1939.

XVIII.—OCCURRENCE OF THE SWINHOE'S SNIPE [*CAPELLA MEGALA* (SWINHOE)] IN MYSORE.

It may be of interest to record the bagging of 3 Swinhoe's Snipe during the season 1938-9 within a 40 mile radius of Mysore City.

This is the first record I have of its occurrence in this area, and it is evidently even less common there than in Malabar as the following figures for the past 14 years show :—

	Pintails	Swinhoe	
Mysore	1973	3	or 1 to 658
Malabar	5321	19	or 1 to 280.

WINCHCOMBE, E. G. PHYTHIAN-ADAMS,
KALHATTI P.O., NILGIRIS, *Major I.A.* (*Retd.*).
SOUTH INDIA.
April 20, 1939.

XIX.—RECORDS OF SNIPE SHOT IN THE TINGRI DISTRICT, ASSAM.

With reference to the note on 'Arrival and stay of snipe in Assam', by Mr. R. E. Parsons, in vol. xl, No. 1 of the *Journal,* the following may be of interest:—

For the Tingri District, North Lakhimpur, my records show the following bags with the respective dates—

1936	April	4th	... ...	4	Couple.
	,,	20th	... ...	5	,,
1937	March	15th	... ...	4½	,,
	April	10th	... ...	3½	,,
	,,	24th	... ...	10	,,
	May	1st	... ...	6	,,

While after duck on March 8th 1937, in the Sibsagar District, I picked up 3½ couple.

I am afraid I cannot say whether the above were Fantail or Pintail as unfortunately I did not identify them at the time.

This year in this district, Sibsagar, I killed a couple of Pintail on April 10th and later saw a further couple, one bird on April 19th and one on April 21st.

Although I have very frequently wandered around the spots, where the above birds were killed, at all times of the year, I have never come across any until well into the beginning of the year, in fact we never thought of snipe until February-March.

DHOOLIE T.E.,
TITABAR P. O., H. R. D. ROBEY.
ASSAM.
May 5, 1939.

XX.—BREEDING OF THE GREAT BLACK-HEADED GULL (*LARUS ICHTHYAËTUS* PALLAS).

Ludlow in his *Birds of the Gyantse Neighbourhood*—Southern Tibet records that he saw on the Hram Tso some gulls which did not appear to him to be *Larus brunnicephalus* but that he was unable to obtain a specimen.

I have seen gulls there which were distinctly larger than *L. brunnicephalus* and here in Lhasa two distinct species may be seen on the Kyichu river. Birds here are so fearless that close observation is easy. I consider that the larger species is *Larus ichtyaëtus*. The appearance agrees with the description given by Stuart Baker but I have not yet heard its 'loud raucous cry' only a faint croak. Most of the birds are in winter plumage but one or two have the black head of full plumage.

Owing to Tibetan religious scruples it is not possible to obtain a specimen.

LHASA,
TIBET.
January 8, 1939.

H. E. RICHARDSON,
I.C.S.

XXI.—OCCURRENCE OF SHELDUCK (*TADORNA TADORNA*) AND GODWITS ON THE CHILKA LAKE.

Last year I reported through Mr. Clough on the abnormal quantity of Shelduck (*Tadorna tadorna*), on Chilka Lake. This year, as usual, there are practically none. Although I looked at a large number of Godwits with a powerful telescope, I was quite unable to pick out another Snipe-billed, one of which I shot last year. I do not think they can be identified unless taken in the hand. I think, however, that quite a few are either trapped or shot annually and that neither the sportsman nor the netter has sufficient knowledge or the inclination to identify them.

4 ALIPORE ROAD,
CALCUTTA.
February 4, 1939.

H. A. FOOKS.

XXII. MAHSEER AND TURTLE.

At about 8 a.m. on the 14th January 1939, His Excellency the Marquess of Linlithgow was fishing in the Cauvery River about 2 miles from Seringapatam in a large pool. The bait used was a mixture of *atta* and *goor*. About five minutes after the bait had been thrown in, it was taken by a masheer which weighed 14 pounds. On landing the fish there was no bait on the hook, but in the mouth of the fish was a turtle (*Lissemys punctata*) alive. It is presumed that the turtle was feeding on the bait which was at the bottom of the pool and the masheer took the bait and turtle. His Excellency played the fish for about ten minutes. The turtle, which is at present in Bombay, is none the worse for its alarming experience, and is feeding freely.

VICEROY'S CAMP,
INDIA.
January 26, 1939.

C. G. TOOGOOD,
Lt.-Col.,
Military Secretary to the Viceroy.

XXIII.—EXTENSION OF THE RANGE OF THE MICROHYLID FROG [*UPERADON SYSTOMA* (SCHN.)].

Last August I obtained two specimens of *Uperadon systoma* (Schneider) at Agra: one, from the large rain-water drain between the St. John's College Staff Club grounds and the Hariparbat

Police Station; and the other from Nala Burhan Sayyad. The former specimen might have come floating down from farther up, and the latter was discovered hidden under an earthen jar of water near a hut.

The discovery of *Uperadon systoma* at Agra considerably extends the range of the species north-west-wards. Boulenger (1890)[1] gave for its habitat, 'Carnatic, Biligirirangan Hills, Mysore, Madras', and Ferguson (1904)[2] found this burrowing frog 'fairly common in the low country' in Travancore. Nieden (1926),[3] probably on Boulenger's testimony, says 'Vorderindien'; whilst Parker (1934)[4] gives its distribution as 'Southern and Eastern India as far north as the valley of the Ganges; Ceylon.' Parker examined specimens from Madras, Russelconda (Madras Presidency), Balarangam Hills, Malabar and Trivandrum, and Dr. Malcolm Smith (British Museum, London), in a letter dated September 9, 1938, assures me that the species has so far been recorded only as far north as the C.P.

The colouration of the specimens found at Agra agrees in general with the description given by Boulenger and Parker. However, the throat is neither immaculate, nor faintly mottled with brown, as mentioned by them. The lower lip is edged with a distinct yellow border and the vocal sac, which lies flapped up forwards, apposed to the throat, is coloured dark anteriorly, the darkness showing through the skin.

I am indebted to Dr. Malcolm A. Smith for kindly confirming my determination, and to Dr. Baini Prashad for the loan of Parker's 'Monograph on the Microhylidae' for reference.

ST. JOHN'S COLLEGE, BENI CHARAN MAHENDRA.
AGRA.
January 24, 1939.

XXIV.—NOTES ON *PIERIS BRASSICAE* IN CHAMPARAN.

1930.
- February 8. Noticed a female *P. brassicae*.
- February 17. More females appear.
- March 5. $\frac{1}{2} \times \frac{1}{4}$ grown larvae seen on cabbages in the garden.
- March 13. Larvae pupated.
- March 24. Butterflies emerge.
- April 15. Noticed full grown larvae of 2nd brood. (I went on leave about this time and did not see them emerge.)

1931. Can find no record.

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[1] Boulenger, G. A.—*Fauna Brit. Ind., Reptilia and Batrachia*, 1890.

[2] Ferguson, H. S.—*Jour. Bom. Nat. Hist. Soc.*, xv, p. 507, 1904.

[3] Nieden, Fr.—*Das Tierreich, Anura II*, p. 20, 1926.

[4] Parker, H. W.—'A Monograph of the Frogs of the Family Microhylidae', *Brit. Mus., London*, 1934.

1932. February 1. Saw one female only *P. brassicae.* There were no larvae seen this year.
December 21. Noticed one specimen of them. A very early appearance.
1933. My only record is 'last brood emerged on April 16th. They must have been plentiful.'
1934. First appearance of a ♂ on 22nd January. Last brood hatched out before 30th April.
1935. No butterflies appeared till middle February.
1936. The same note applies to this year.
1937. Butterflies seen in January and February in good numbers. October 17. Noticed one *Vanessa cardui* on this date—an early appearance for this place.
1938. Butterflies arrive early and larvae were in best form in the garden.
1939. No butterflies were seen at all but I noticed full grown larvae on the cabbage on 31st March—Magines emerged on April 12th and 13th but not seen afterwards.

RAJGHAT CONCERN, A. C. HARMAN.
P.O. BETTIAH,
CHAMPARAN.
April 25, 1939.

XXV.—THE MIGRATION OF BUTTERFLIES.

Having read Mr. C. B. Williams' article in the last number of the Society's *Journal,* I am sending under separate cover butterflies taken while flighting and the following are notes made by me of a few instances of butterflies migrating, with the hope they may be of some use.

Appias (*Catophaga*) *paulina.* Both ♂♀ flight in large numbers during the early part of the year. Flying in a westerly direction from Haputah (elevation 5,000 ft.) this flight is a regular occurrence and I have two records of the date of its commencement, in 1936 on March 19th and 1937 March 10th. This flight last for four or five days and thousands of butterflies must pass by. They are all going in one definite direction but do not fly very fast. They fly at a height only just above the tea and go straight up over any obstacle such as a strip of jungle. Other butterflies are amongst them but in no great numbers.

Another similar flight takes place in the latter part of the year. This time in a more northerly direction. These flights *do not* occur in the Dickoya District (samples of butterflies caught sent).

Papilio demoleus. Appeared in large numbers at Dickoya in November and December 1937 and seemed to be flighting, I can remember similar instances at Haputah. The rest of the year they are not seen up-country.

Papilio (*Pathysa*) *nomius*. This butterfly was in large numbers resting in wet sand by the roadside at Trincomalee, August 7th 1936. It was *definitely not* flighting; but this may be one of its breeding centres.

Tyrameis cardui. Breeds on this estate (elevation 4,000 ft.) in large numbers throughout the year. The larva feeds on a weed locally called Wild Chrysanthemum.

Atella phalantha. I have two records of this fly appearing in large numbers but it does not seem to be flighting in any particular direction. Haputah, October, November 1935 and from Dickoya November 1937.

DUNBAR, J. N. CORBETT.
DICKOYA, CEYLON.
February 6, 1939.

The following is a list of the Butterflies taken while flighting by J. N. Corbett. 16-2-39.

1	*Appias*	*paulina*	♀
2	„	„	♀
3	„	„	♀
4	„	„	♀
5	„	„	♀
6	„	„	♀
7	„	„	♂
8	„	„	♂
9	„	„	♂
10	„	„	♂
11	*A.*	*venusta*	♂
12	„	„	♂
13	„	„	♀
14	„	„	♂
15	*Pathysa*	*nomius*	
16	„	„	
17	„	„	
18	„	„	
19	*Atella*	*phalantha*	
20	„	„	
21	„	„	
22	„	„	
23	„	„	
24	„	„	

EDS.

XXVI.—VARIATION IN THE LEAVES OF *EUPHORBIA CADUCIFOLIA* HAINES.

(*With* 3 *plates*).

Euphorbia caducifolia was first described by Haines in the *Indian Forester*, vol. xl, p. 154 in 1914. The following is the description of the leaves in the words of the finder:—Folia caducissima juventute late-ovata margine crispato. The specimens were collected from Satpura Hills and in the Raipur District of the Central Provinces.

In the *Botany of Bihar and Orissa*, Part II, 1921, Haines again describes this species as having leaves broadly ovate with crisped margin, becoming more oblong-obovate and cuspidate with age, reaching 2-3 inches long and then falling. This description is drawn from plants growing on rocks in the coast at Puri.

In 1923 C. E. C. Fischer in his *Descriptive List of Forest Flora of East Central Madras* describes the leaves of his plants as fleshy, rounded; $\frac{1}{3}$-$\frac{1}{2}$ inch long and falling early. His description was based on his observations of plants in the Palkonda Hills, Yerramalais of Kurnool and in the Palnad of Guntur.

Fischer again in *Kew Bulletin*, 1925, pp. 341-343 drew up a further description of this species. The following is his description of the leaves:—Folia apice areolarum solitaria, ante anthesin decidua, suborbicularia, acuta, crassa, carnosa, glabra 8-12 mm. longa, leviter conduplicata, marginibus crispato-undulatis. Fischer's description is based on that of Haines and on his extensive observations of plants in the Cuddapah District.

My observations being limited to a portion of the Ceded Districts of the Madras Presidency to two excursions of short duration I have had no opportunity of seeing the plants which Haines has described. However, I have been able to recognise three forms of leaves which I have described below.

FORM I.

A specimen collected by me at Guntakal in Bellary District, Pl. I, fig. a, agrees with Fischer's type. Another specimen, Pl. I, fig. b, that I collected from Rayadrug of the same district agrees with this except for the larger size of the leaves. Leaves are thicker than in any other forms, light green, nerveless forming a channel along the middle and hence concave on the inside and convex on the outside, midrib not perceptible, 1 inch long and almost as broad, margin very slightly undulate.

FORM II.

In this form, Pl. II, the leaf is succulent, elliptic, dark green, the midrib perceptible, secondary veins not perceptible, 2½ inches long, 1½ inches broad, margine entire except for the formation of a single fold on either side somewhat below the apex, depressed along the middle, apex in most cases acute with a sharp point or rarely rounded. In rare cases the marginal fold is absent. In this form we notice an obscure beginning towards a crispate margin. I collected this form from Gooty Fort, Anantapur District.

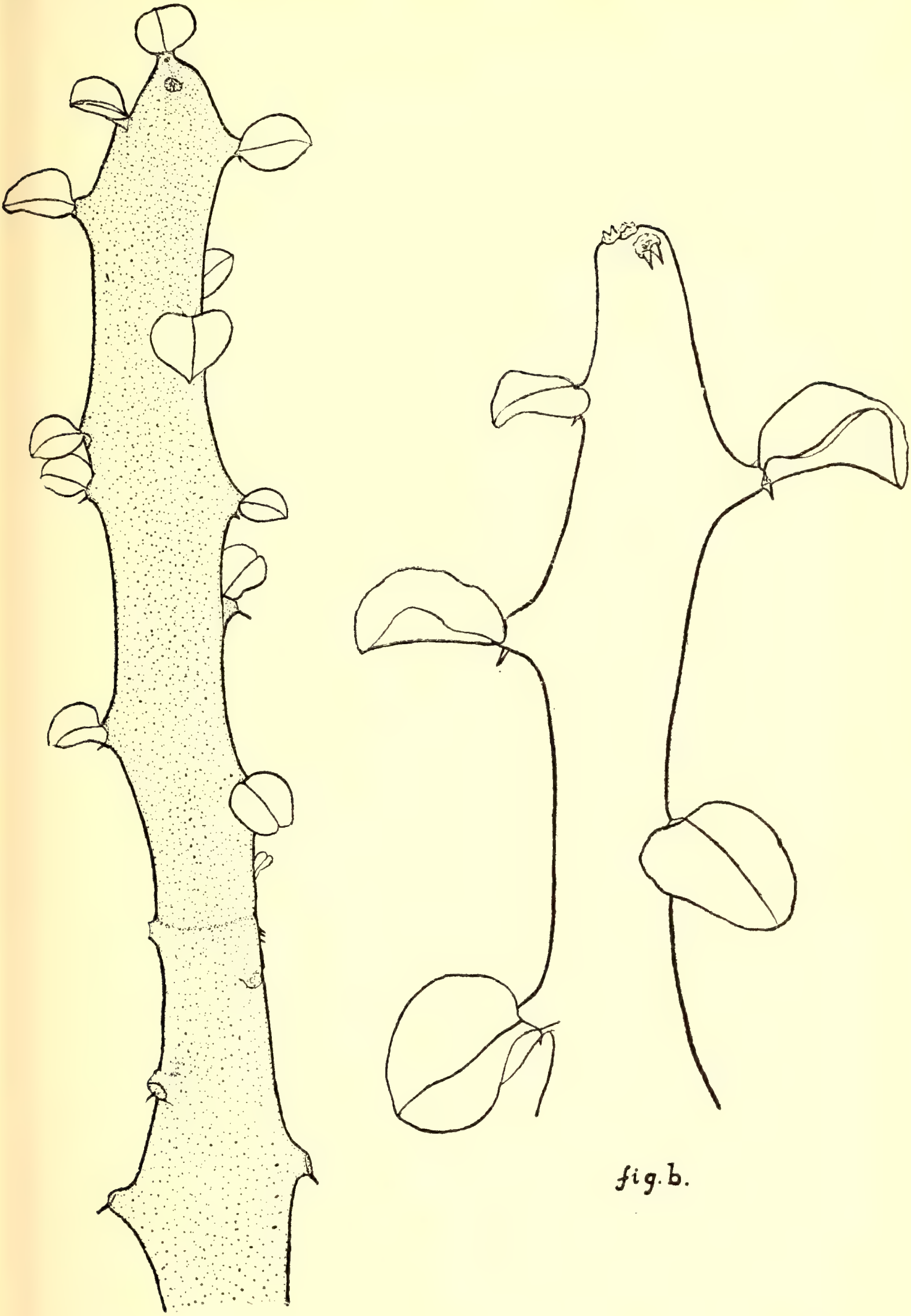
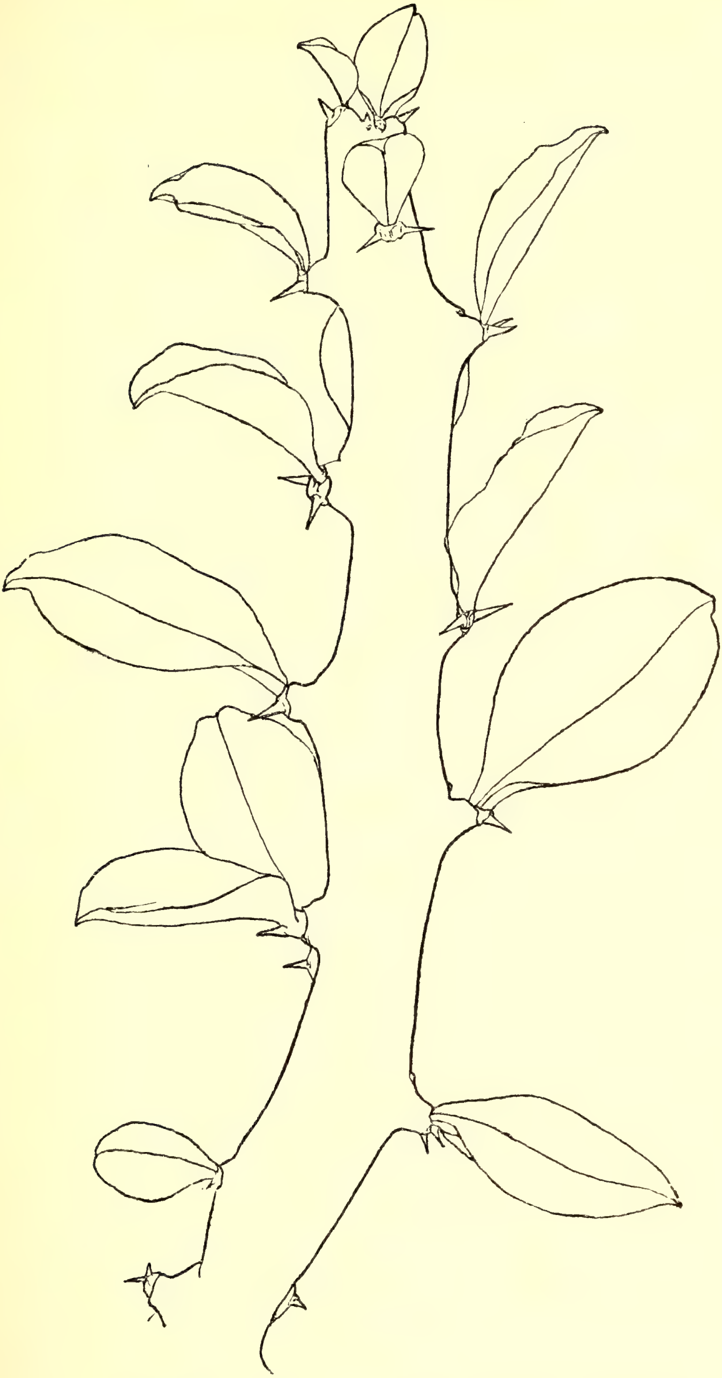


fig. a.

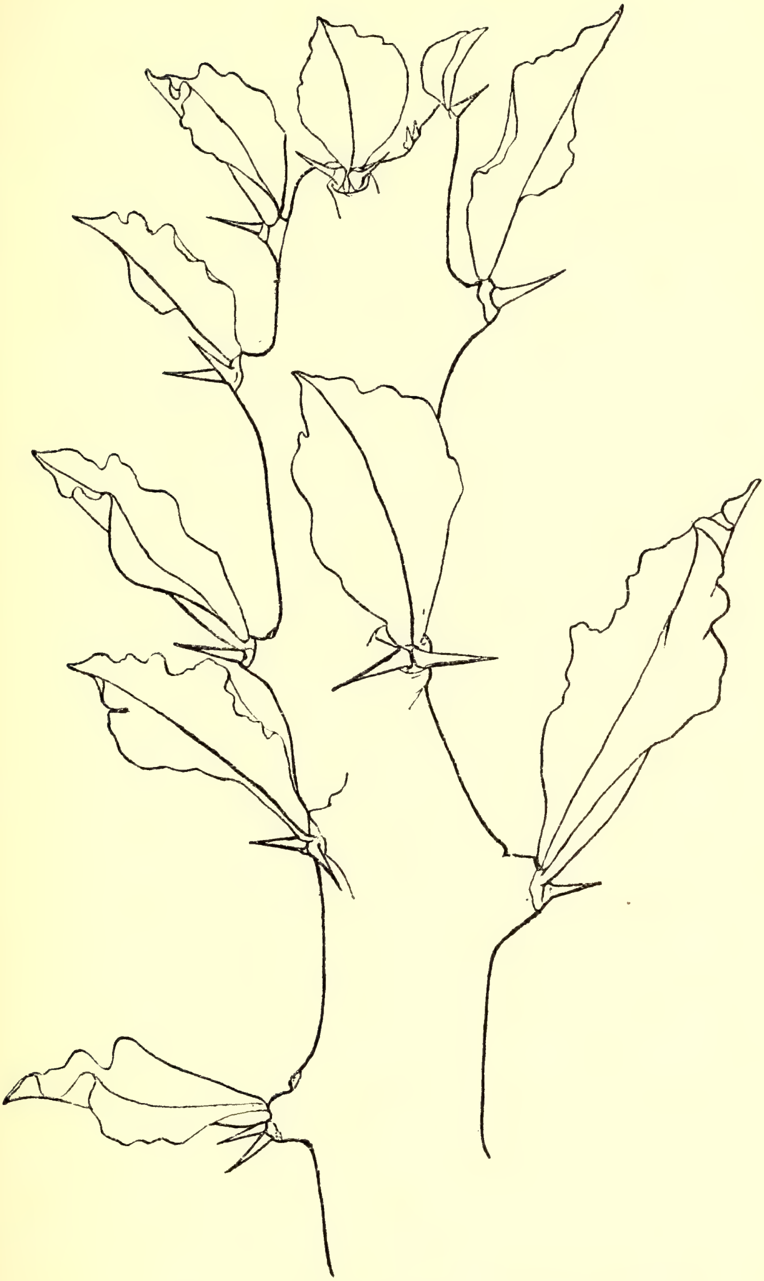
fig. b.

Variation in leaves of *Euphorbia caducifolia* Haines.
Form I



Variation in leaves of *Euphorbia caducifolia* Haines.

Form II



Variation in leaves of *Euphorbia caducifolia* Haines.
Form III

FORM III.

In this form, Pl. III, the apex is drawn out to a short point and the margin is crispate. The leaf is elliptic, 2½ inches long 1½ inches broad. In thickness colour and venation it resembles From II. I collected this plant from near Gooty Town.

In all the three forms the leaves appear about July and shrivel and fall off completely before December. All the above forms were grown from cuttings in Madras in the garden of the Government Museum under identical conditions for purposes of investigation.

USES.

In the Ceded Districts this species is known as *kola jammudu* among the Telugus and *bala galli* among the Kannada people. A few leaves taken with betel leaf and areca nut is considered a cure for malaria. The milky juice is believed to be a remedy in cases of fractures, the injured part being anointed with the juice and bandaged and cold water poured over the bandage. The stems are planted to form live fences. They are used as green manure or are burnt for fuel.

PLATES.

Drawings of this species have not appeared so far and hence the following plates drawn to natural size may be found useful. They also show the transition from Form I, a to b and thence through Form II to III.

GOVERNMENT MUSEUM,
MADRAS
February 13, 1939.

P. V. MAYURANATHAN,
Curator, Botany Section.

PROCEEDINGS OF THE ANNUAL GENERAL MEETING OF THE BOMBAY NATURAL HISTORY SOCIETY.

The Annual General Meeting of Members of the Bombay Natural History Society was held on Tuesday the 18th April at 5 p.m. in the Prince of Wales Museum; His Excellency the Governor of Bombay presiding.

AGENDA.

1. Reading of the Annual Report of the Committee.
2. Presentation of the Balance Sheet and Statement of Accounts for the past year.
3. Election of the Committee.

The Honorary Secretary announced the election of 28 new members since the last meeting held on 28th July 1938:—

Dr. R. V. Clayton, V.D., M.B., B.S., etc. Bandra; H. H. the Maharaja Saheb Dewas Junior, Dewas State; Col. Kenneth Comyn, R.A.M.C., Meerut; Rajah of Ettaiyapuram, The Palace, Ettaiyapuram, Tinnevelly Dist.; Mr. F. Woolley Smith, Hoogrijan P.O., Assam; Mr. Sayed Mohammed Ali, Cawnpore; Mr. G. R. Leonard, Pahang, F.M.S.; Shreemant Capt. Y. B. Pawar, Yuvaraj Dewas, Junior Branch; H. H. the Maharaja Sir Sawai Mansinghji Bahadur, G.C.I.E., Jaipur State; Mr. R. J. A. Moore, Travancore; Dr. M. H. Weinberg, M.D., Bombay; The Mess Secretary, 10/7th Rajput Regiment, Fatehgarh, U.P.; Major J. H. B. Lowe, R.E., Wana, Waziristan; Major J. R. West, Hongkong; Mr. L. J. D. Fraser, I.A., Landikotal, N.-W.F.P.; Mr. E. Burnham Chamberlain, Charleston, South Carolina, U.S.A.; Lt. Gavin Nott, Almora, U.P.; Mr. D'Arcy Weatherbe, F.R.G.S., Hongkong; H. H. Raja Anand Chand of Bilaspur State, Punjab; Mr. G. Critchley, Bombay; The Librarian, Dartmouth College Library, Hanover, New Hampshire, U.S.A.; Mr. Charles S. Ogilvie, Pahang, F.M.S.; Mr. Dwijapati Maitra, Calcutta; Mr. N. H. Barne, Calcutta; Mr. James McPherson, London; H. H. Raja of Jawhar, Jawhar State; Mr. C. B. Redway, Penang, F.M.S., Kumar Shree Dharmakumarsinhji, Bhavnagar.

BOMBAY NATURAL HISTORY SOCIETY.

Office Bearers—1939.

Patron.—H. E. The Viceroy of India.

Vice-Patrons.—H. E. H. The Nizam of Hyderabad, G.C.S.I., G.B.E.; H. H. The Maharaja of Baroda; H. H. The Maharaja of Travancore, G.C.I.E.; H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E.; H. H. The Maharaja of Jodhpur, G.C.I.E., K.C.S.I., K.C.V.O.; H. H. The Maharajadhiraj of Patiala; H. H. The Maharaja of Rewa, K.C.S.I.; H. H. The Maharaja of Bhavnagar, K.C.S.I.; H. H. The Nawab of Junagadh, G.C.I.E., K.C.S.I.; Sir David Ezra, Kt., F.Z.S.; F. V. Evans, Esq.; A. S. Vernay, Esq.; Lt.-Col. K. G. Gharpurey, I.M.S. (Retd.); W. S. Millard, Esq., F.Z.S.

The following gentlemen were elected to serve on the Managing Committee for the ensuing year:—

President.—H. E. Sir Lawrence Roger Lumley, G.C.I.E., D.L.

Vice-Presidents.—H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E.; Rev. Fr. J. F. Caius, S.J., F.L.S.; and Rt. Revd. R. D. Acland, M.A.

Executive Committee.—Mr. Farrokh E. Bharucha; Mr. A. Forrington; Mr. J. B. Greaves, M.L.A.; Mr. M. J. Hackney; Mr. R. E. Hawkins; Mr. D. G. Hill; Lt.-Col. W. C. Spackman, I.M.S.; Lt.-Col. S. S. Sokhey, I.M.S.; Mr. F. Wadia; Mr. P. M. D. Sanderson, F.Z.S. (*Honorary Secretary*); Mr. H. M. McGusty (*Honorary Treasurer*).

Advisory Committee.—Dr. C. F. C. Beeson, D.SC., M.A., I.F.S.; Lt.-Col. R. W. Burton, I.A. (Retd.); Mr. C. H. Donald, F.Z.S.; Dr. F. H. Gravely, D.SC.; Mr. C. M. Inglis, B.E., M.B.O.U., F.Z.S.; Mr. R. C. Morris, F.R.G.S., F.Z.S.; Major E. G. Phythian-Adams, F.Z.S., I.A. (Retd); Dr. Baini Prashad, D.SC.; Mr. H. C. Smith, I.F.S.; Lt.-Col. C. G. Toogood, C.I.E., D.S.O.; Mr. J. H. Williams.

ANNUAL REPORT OF THE BOMBAY NATURAL HISTORY SOCIETY FOR THE YEAR ENDING 31ST DECEMBER 1938.

ADMINISTRATION.

President.—H. E. Sir Roger Lumley, G.C.I.E., D.L.

Vice-Presidents.—H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E.; Rev. Fr. J. F. Caius, S.J.; Rt. Revd. R. D. Acland, M.A.

Executive Committee.—Mr. Farrokh E. Bharucha; Mr. A. Forrington; Mr. J. B. Greaves, M.L.A.; Mr. M. J. Hackney; Mr. D. G. Hill; Mr. H. L. Shoveller; Lt.-Col. W. C. Spackman, I.M.S., Lt.-Col. S. S. Sokhey, I.M.S.; Dr. S. A. Wilkinson, M.R.C.S., L.R.C.P.; Mr. F. Wadia; Mr. P. M. D. Sanderson, F.Z.S. (*Honorary Secretary*); Mr. H. M. McGusty (*Honorary Treasurer*), Bombay.

Advisory Committee.—Dr. C. F. C. Beeson, D.SC., M.A., I.F.S., Dehra Dun; Lt.-Col. R. W. Burton, I.A. (Retd.), Coonoor; Mr. C. H. Donald, F.Z.S., Dharamsala; Dr. F. H. Gravely, D.SC., Madras; Mr. C. M. Inglis, B.E., Major E. G. Phythian-Adams, F.Z.S., I.A. (Retd.), Nilgiris; Dr. Baini Prashad, D.SC., Calcutta; Mr. H. C. Smith, I.F.S., Maymyo; Lt.-Col. C. G. Toogood, C.I.E., D.S.O., Delhi; Mr. J. H. Williams, Coimbatore.

Staff.—S. H. Prater, M.L.A., J.P., C.M.Z.S. (*Curator*); C. McCann, F.L.S. (*Assistant Curator*).

THE HONORARY SECRETARY'S REPORT FOR THE YEAR 1938.

The Society's Journal.—The Journal entered upon its xl volume. Three numbers were issued during the year under review.

MAMMALS.

Among the papers on Mammals, Mr. Theodore Hubback's article on the Malayan Gaur or Seladang is of particular interest. Lydekker differentiated the Gaur inhabiting the forests of the Malay Peninsula as a separate racial form, distinguishable from the Indian Gaur by the smaller development of the cranial ridge between the horns, so pronounced in the Indian Gaur, by its colour and markings, and by the presence of a dewlap. Mr. Hubback indicates that the presence of a dewlap cannot be regarded as a distinctive character of the Malayan animal. As with gaur in India, the development of a dewlap is a purely individual distinction. Mr. Hubback regards the Gaur as a comparatively recent immigrant into the Malay countries, and considers that its existence in this region has been made possible through human agency. Gaur take shelter in forest but feed mainly in open grazing grounds and clearings. As such, the Malay Peninsula, covered except for the summits of its highest mountains, with dense forest was originally unsuitable as a habitat for these animals. The extension of their range into the Malay countries was made possible, not by the aboriginal tribes who live mainly by hunting or on forest produce, but by subsequent and more recent settlers. These lived by cultivation and made clearings in what was originally virgin forest land and so provided gaur with grazing grounds essential to their existence. Mr. Hubback's contention supports the theory that the Gaur originated in India. The fossil remains of an ancestral form of gaur (*Bos namadicus*), which had much larger horns than the Gaur of our times, have been discovered in the Pleistocene beds in India. From India, it is believed its present day descendants have spread by way of Assam and Burma into the Malay countries. Mr. Hubback writes of the ways and habits of the Gaur in the Malay jungles. Based on personal observation over many years, his paper is a valuable contribution to the natural history of the animal, and his fine photographs add much to its attractiveness. Mr. Hubback is pessimistic about the future of this magnificent animal in Malaya. His opinions, as an eminent authority on the conservation of Wild Life, must command attention. Mr. Hubback indicates that the only hope for the larger wild animals of Malaya is the provision and rigid maintenance by Government of sanctuaries, whose boundaries must remain inviolable and whose sole purpose must be the protection from human interference of the wild animals they contain. Reductions in the areas so reserved, for whatever purpose, if once permitted, would establish a precedent which would lead eventually to the sacrifice of these ultimate refuges in which wild animals can find their sole chance for survival.

Birds.

Scientific Surveys.—In 1923, His Highness the Maharaja of Jodhpur accepted the offer made by the Society to carry out an Ornithological Survey of his State and very generously made a grant of money for this purpose. The survey was carried out by Mr. V. S. LaPersonne, then Assistant Curator of the Society. Mr. LaPersonne worked in the field from October to January 1923. The collection made by him provides a picture of the bird life of the State during this period of the year. The avifauna of Jodhpur is mainly typical of that of the neighbouring provinces of Sind, Rajputana and the southern districts of the Punjab, where similar conditions of climate, soil and plant life prevail. As the bird life of these adjoining areas had already been investigated and reported upon, the survey of Jodhpur was not expected to produce any new data, but it helped to give more precise information of an area about which there was actually little on record. Supplementing the data obtained through the survey with previous records, Mr. Whistler's report of the Survey of Jodhpur gives a list of all the species known to occur within the State. His report serves as a basis for such future workers as may wish to make a more exhaustive and critical study of the ornithology of Jodhpur. The thanks of the Society are due to His Highness the Maharaja of Jodhpur and to his Government for the assistance given to the Society in carrying out this work.

Our grateful acknowledgments are also due to Mr. Whistler whose work has been associated so intimately with various Ornithological Surveys carried out by the Society, and whose careful and detailed reports on the collections made have added so much to the value of this work.

During the year under review the Ornithological Survey was extended from Jodhpur eastwards into the Central Indian States. The territories covered being Bhopal, Gwalior, and Indore. Bhopal and Gwalior were worked between January and April; while the Survey of Indore State was undertaken in August and September specially to provide data of monsoon bird life. The thanks of the Society are due to the Rulers of these States for monetary grants made to the Society and for other facilities given to our collectors in the field. The Surveys were carried out by Mr. Salim Ali, whose reports with notes by Mr. Whistler will be published in the *Journal.* There are few workers in the field who are making a greater contribution to recent progress in Indian Ornithology than Mr. Salim Ali. During the past eight years he has carried out important Ornithological Surveys organized by the Society in various parts of India. Mr. Ali's knowledge of all that is essential to successful field collecting and his keenness and love for the work have contributed greatly to the success of his field work and have added much to the interest and value of his reports. We gladly take this opportunity of expressing our thanks and appreciation of his services to the Society.

During the year, arrangements were made with the Bahawalpur Government for a survey of Bahawalpur State, and our thanks are due to His Highness the Maharaja and his Government for contribution of Rs. 3,000 towards the expenses of this survey. Mr. Salim A. Ali will carry out this survey on behalf of the Society early in 1939.

Arrangements have also been made for an Ornithological Survey of the State of Mysore in co-operation with the American Museum of Natural History, New York. The Society has been anxious for many years to survey this territory to complete its surveys of the avifauna of Southern India. We wish to thank His Highness and his Government for giving the Society permission to carry out this survey and for the contribution they have agreed to make towards the cost.

Birds of the Laccadive Islands.—Papers on Birds included Mr. Betts' account of observations made during his visit to the Laccadive Islands. The only previous account of the bird life of these islands is Hume's report of a visit he made in February, 1873. Unfortunately Mr. Betts' report is based on observations made during an identical period of the year. Mr. Betts' report indicates that the Laccadive Islands, with their limited range of plant life and corresponding scarcity of insect life, provide an unsuitable environment for settlement by birds. Only two species appear to have established themselves, the Crow, probably introduced by human agency, and the White-eye. The remainder of the species met with were passage migrants. The author comments upon the scarcity of sea birds in the neighbourhood of the main islands during the time of his visit.

Southern India.—Mr. Biddulph's paper on the birds of Rameswaram Island covers observations made over a period of two years. It is an interesting study of the birds of an island, situated close to the mainland, in the path of movement between India and Ceylon, where general conditions are favourable to the existence of a more abundant and varied bird life. As series of skins for purposes of comparison were not collected by the author, it was not possible to ascertain whether the resident species of the Island exhibited any differentiation from the forms inhabiting the mainland or Ceylon. Mr. Biddulph's observations will serve as a basis for future workers. His paper is the first comprehensive record of the avifauna of the Island; the information he makes available helps in many instances to supplement the data obtained by the surveys in South India.

Other contributions to the ornithology of Southern India include Mrs. A. Barnes' paper on birds observed in and near Tambaram, Chingleput District, some 16 miles south-west of Madras, and supplementary papers on the Birds of Hyderabad by Mr. S. A. Ali, and on the Birds of Travancore and Cochin by Mr. J. B. Primrose. Mr. Ali adds nine species, not previously recorded in his report of the Survey of Hyderabad, and gives additional data establishing the status of species obtained during the survey or confirming species included in his original list on sight records. Mr. Primrose's observations on Travancore birds is the result of two visits to Munnar, made between April and June 1937, and April and May, 1938. He adds considerably to the list of species recorded from the Munnar area during the recent survey. Mr. Betts' paper on the Birds of a Coorg Down, deals with a section of the boundary line between two distinctive ornithological zones in South India—the dry zone represented by the central plateau and the wet zone covering the Western Ghats and its spurs. Mr. Betts' observations indicate that the dry zone types, which predominate in this boundary area, are mainly species or sub-species typical of the greater part of India, while the wet zone forms are those limited to the south-west of the Peninsula. Further, while the purely wet zone species are rarely found outside their characteristic habitat, there is an annual westerly invasion of dry zone birds into the wet zone in the cold weather, and a retreat just before the rains. In distinction to long distance migrants, the movement from the dry into the wet zone is not general or uniform. Different species enter, remain within, or leave the wet zone in response to their particular needs.

Bombay.—Parts IV and V of the *Birds of Bombay and Salsette* by Messrs. Salim Ali and Humayun Abdulali were published during the year. The passerine species are concluded and the serial is carried as far as the Game Birds—the concluding part dealing with waders and aquatic birds will be published with the first number of 1939, when it is proposed to issue the articles in book form.

Kashmir.—Major R. S. P. Bates writes an account of a photographic expedition through the Upper Wardwan Valley in the Kashmir Province of Kishtwar and gives notes on the breeding of various species, illustrated with a number of beautiful photographs.

Most attractive to readers of the *Journal* are Mr. Lowther's notes on Indian Birds. In Part III of the series published during the year Mr. Lowther writes on 'Birds in my Garden'. Mr. Lowther is to be congratulated not only on the excellence of his photographs but also on what he writes. Based on a store of experience, the result of many years of patient bird watching, his article makes deligthful and interesting reading.

REPTILES AND FISHES.

In his paper on the Taxonomic Description of *Rhinophis travancoricus*, Mr. Beni Charan Mahendra, proposes certain changes in the taxonomic description of this species.

A paper on the Reptiles of Cutch State was contributed by Mr. C. McCann. It is based on a collection made by the author during a three weeks' tour of the great Rann, and on material in the Society's collection and other recorded data.

Game Fishes of India.—Parts IV and V of this serial were published during the year under review. Part IV deals with *Silonia silondia*, one of the large cat-fishes, which from its voracious habits and powerful build, is sometimes described along with other large cat-fishes under the general name of 'Fresh Water Sharks'. Part V deals with a second species of these large cat-fishes (*Pangasius*). Dr. Hora's papers form a valuable contribution to Indian Icthyology and should provide students and laymen with helpful information. But the Society's aim in publishing articles went a little further. It was originally intended that these articles should follow the general lines of Stuart Baker's *Game Birds of India* and provide information on the lives and habits of the fishes described. While information on the natural history of Indian Birds is generally available, little has been recorded of the ways and habits of Indian Fishes. For such information the author is largely dependent on the co-operation of the readers of the *Journal*. We repeat the appeal we originally made to anglers and others interested in fish and fishing to send us their notes and observations and so help to add to the popular and general interest of these articles. There are, we feel sure, among our members, many who could send us interesting notes on their fishing experiences and we should greatly appreciate and gladly acknowledge such assistance.

Aerial vision in fishes.—In an interesting article on the freshwater Grey Mullet (*Mugil corsula*), Dr. Hora discusses the origin of aerial vision in fishes. He differs in his views from the theory put forward by Noble that the development of aerial vision in fishes, which possess this power, commenced with a bifocal stage as is exhibited in *Anableps*, the 'Four-eyed fish' of Tropical America. In this species the eye is divided by an ingrowth of the iris into an upper section designed for use above, and a lower section for use below water. Hora considers that the complicated structure of the eyes in *Anableps* has been specialized and perfected under the peculiar conditions and habits of life of these fishes. The species feeds on the 'floating material which it encounters in the dual realm of air water.' Whereas in the case of estuarine fishes, such as the Gobies, which at low tide are left in hundreds on our mud flats, and the Grey Mullet, aerial vision was acquired without undergoing the preliminary stage of bifocal vision developed in *Anableps*.

In Part III of the *Fishes of Deolali*, Dr. Hora continues his report on the collection of fresh water fishes made at Deolali by Mr. A. G. L. Fraser. Part III gives a complete list of the fish fauna of Deolali, and describes two new species of *Barbus* and *Parapsilorynchus*. This concludes a valuable report on the fishes of this area made possible by the very complete material collected by Mr. Fraser. Our acknowledgments are due both to Dr. Hora and Mr. Fraser for the work which has been done. A complete set of the fishes obtained has been placed in the Society's collection.

In his paper on the Bionomics of *Panchax lineatus*, Mr. Fraser puts forward an interesting explanation of the 'silver spot' or star-like marking so prominent on the head of these little fishes. The mosquito eating propensities of the genus *Panchax* are well known. Fraser's observations showed that *P. lineatus* has the habit of lying for long periods on the surface of the water, a position in which the 'silver spot' on its head, its brilliance heightened by reflected light, becomes prominently noticeable. Fraser's theory is, that the bright silver marking serves to attract insects; as such, in *Panchax* we have a fish which is not only an active agent in destroying adult mosquitoes, but is also a trap for alluring these pests to their destruction. The theory advanced for the first time is well worth investigation.

Dr. Hamid Khan's paper on the food of the Brown Trout is a useful contribution to the question underlying the successful establishment and maintenance of Trout Fisheries in India. No precise information was so far available on the food and feeding habits of the Brown Trout in places where it has been introduced in India. The paper deals with Trout in the Beas River in Kulu, and is based on the examination of the stomach contents of some 102 specimens taken at different seasons. The investigations show that the food of the Brown Trout in this area consists mainly of aquatic and terrestrial insects, of young fishes, and frogs and lastly of snails and crustacea in negligible quantities. The investigations also indicate that the fish have a restricted food supply after the rains owing to the disturbance caused by the floods and that, owing to the scarcity of winged flies, the Trout in the Beas are largely bottom feeders.

INVERTEBRATES

We are able during the year to resume publication of Martin Mosely's articles on Indian Caddis Flies. A feature of these papers, which when completed will constitute the standard work on the subject in India, are the many fine plates, so invaluable to students. The considerable expense involved in their production compelled the Society to suspend publication until funds were forthcoming. Thanks to the generosity of Mr. F. V. Evans, a Vice Patron of the Society, who offered to contribute towards the cost, we have been able to resume publication. Part V which appeared during the year, deals with the family *Sericostomatidae* and contains descriptions of 7 new species.

During the year we commenced publication of Mr. D. G. Sevastopulo's papers on the Early Stages of Indian Lepidoptera. Part of the work already appeared in the *Entomologist's Record* and is being republished with additions and amendments. Descriptions of the early stages of Indian Lepidoptera, commonly available to workers in India in such works as Hampson's volumes on Moths in the *Fuana* of British India, and in Seitz's *Macrolepidoptera*, are vague, incomplete and often incorrect. Mr. Sevastopulo's papers are intended to provide new data or to supplement incomplete information and to correct, where necessary, inaccurate data.

An interesting contribution to the *Journal* is Dr. C. B. William's paper on the Migration of Butterflies in India. While the migrations of birds, mammals or of such insects as locusts, have attracted much study and attention, until recently, little was known or recorded about the migrations of butterflies. In North America, the Monarch Butterfly (*Danais plexippus*) flies in great numbers each autumn from Southern Canada to Florida and Mexico and returns to the northern area in spring. Similar migrations take place between Great Britain and the Continent. Out of 68 species known to occur in the British Isles, 14 are completely dependent on migration from the Continent for their continued existence in Britain. Owing to insufficient study, little is known about the migration of butterflies in India, though flights of butterflies have been known to occur here for many years and a few observers have sent in their observations. The most important contribution to the subject was made by Mr. J. Evershed, F.R.S., who was for many years Director of the Observatory at Kodaikanal, in the Palni Hills, where he observed and recorded directional flights of butterflies on numerous occasions between 1907 and 1914. Dr. Williams in giving a *résumé* of all the information available on Butterfly Migration in India, makes a special appeal to the readers of the *Journal* to send in their observations of directional flights of butterflies whether seen in large or small numbers. What is wanted is the locality, the date and direction of the flight, and, secondly, specimens of insects taken actually in flight for purpose of identification; even one or two specimens would be useful and 50 are none too many. The state of preservation of the specimens so collected is not of major importance. Other data which would be helpful to the study of the problem are such facts as the direction of the wind, the height of the insects above the ground and weather conditions; in fact, any information which might strike the collector as being relevant to the movements of the butterflies. It is known that other insects also migrate. Dragonflies, for instance, are known to migrate in large numbers in many parts of the world;

but there are practically no records of such movements from India.

Other contributions on Insects include notes on the Butterflies of Kashmir by Col. W. M. Logan Home, and the description of a new Coccidium (*Isospora minuta*) by M. Das-Gupta of the Department of Zoology, Calcutta University.

Economic Entomology is represented by Mr. T. V. Subramanyam's paper on the Moth, *Metanastria hyrtaca,* which is one of the more serious pests of cultivated crops in South India; Mr. Brahmachari's paper on the Bionomics of a Bagworm (*Kophene cuprea*), which at times does appreciable damage to Banana Plantations; and Mr. T. V. Ramakrishna Ayyar's observations on two caterpillars of economic importance not previously recorded from South India.

Mr. Subramanyam's article on the Protective Adaptations of Spiders describes the ingenious devices adopted by Indian spiders to protect themselves or secure their food. Little is known of the ways and habits of Indian spiders, and it is hoped that the author's paper will interest readers in this subject.

BOTANY.

Two important and interesting contributions published during the year deal with the countries of origin of two well known trees in India—the Cocoanut Palm and the Sandalwood tree. Writing on the original home of the Cocoanut, Mr. P. V. Mayuranathan provides evidence to indicate that the palm first evolved in what is probably now submerged land to the north west of New Guinea. Its dispersal was affected both by natural and human agencies. The nuts drifting eastwards and westwards over calm tropical seas came to ground and so established the palm from islet to islet in the Southern Pacific. Apart from such accidental transportation, its spread was effected by seafaring Polynesian tribes who carried and established the tree in the islands of the Pacific Ocean, and by Malayan sea rovers, who brought it into the Malay countries. From Malaya, it was probably brought to India by the once maritime Tamils and by the ancient mariners of the Bengal Coast. As regards the place of origin of the Sandalwood tree, Mr. C. E. C. Fischer is of opinion that the Sandalwood tree did not originate in India. After marshalling the evidence for and against its Indian origin, the author puts forward the theory that at a remote period, a scented wood, or woods, was produced by a tree growing mainly in Southern India. This scented wood was used for various purposes and went by the name of *Chandan.* Later, the wood of what is now known as the Sandalwood tree (*Santalum album*) began to be imported and, as it became more and more available, it gradually replaced the indigenous wood. The imported article, at first described under the same name, *Chandan,* eventually completely appropriated the name. Later the plant itself was introduced and slowly established itself in this country. There is little doubt that the tree is indigenous in Timor Island and in one or two neighbouring islands east of

Java, from whence it was exported from the earliest times and from whence it was brought and planted by Indian settlers in the Malay countries, especially in the vicinity of their temples. The peculiar distribution of the tree and its limited range in India, up to the commencement of the present century, are also factors which are against the theory of its origin in this country.

Rev. Father Caius, continues his series of articles on Medicinal and Poisonous Plants of India. The articles published during the year deal with the Medicinal and Poisonous Spurges (*Euphorbiaceae*), to which the plants commonly referred to as 'cactus' in India belong, the *Nymphaeaceae*, aquatic perennial herbs, such as the water lilies, poppyworts, etc., and with the *Magnoliaceae,* which include a number of aromatic trees and shrubs. Fr. Caius' articles are particular opportune at a time when the policy of Provincial Governments is being directed to the development of indigenous systems of medicine, and to the wider employment of indigenous drugs.

A paper on the Plants of Kuwait, based on collections made over a period of nine years, was contributed by Mrs. V. Dickson. Her list of species considerably supplements Mr. Humphrey Carter's paper in the *Records* of the Botanical Survey of India on the flora of this State.

Mr. N. Sayeedud-Din supplemented his previous paper on the flowering plants of Hyderabad State (published in the *Journal* of the Asiatic Society of Bengal) with a further contribution on material since collected by him.

Horticulturists in India will be interested in Mrs. Robinson's article on the raising of *Hibiscus* plants from seeds. Most species of *Hibiscus*, so attractive and popular in our gardens, are propagated from cuttings and rarely produce seed. Mrs. Robinson gives information regarding three varieties, which from the colour of the flowers she calls 'Peach', 'Sunrise' and 'Cherry', which produce seed freely. The beautiful coloured plate issued with the article is the work of the author to whom our thanks are due.

Forthcoming Publications.—We are glad to announce the forthcoming publication of a series of articles on the Beautiful Flowering Shrubs and Climbing Plants of India by Dr. N. L. Bor, Forest Botanist, Forest Research Institute, Dehra Dun, and his colleague Mr. M. B. Raizada. Dr. Bor, proposes that his articles should follow more or less the lines of Blatter, and Millard's book on *Beautiful Indian Trees*, which first appeared in the *Journal.* We feel sure that Dr. Bor's idea will commend itself to horticulturists and lovers of gardens in India. There are so many beautiful shrubs and climbers in our gardens, which people would like to name and to know something about. These articles will help them. They will be as attractively illustrated as the serial on trees. Specimen illustrations executed by the artist of the Dehra Dun Institute, have been submitted to us. They are of a very high standard and will secure general appreciation. A list of the species to be included in the serial has been sent to us by Dr. Bor. Mr. W. S. Millard, late Honorary Secretary of the Society and a noted horticulturist, has made suggestions in regard to the species to be dealt with, and has very kindly placed his fine collection of paintings at the disposal of the Society. Our thanks are due to Dr. Bor and his collaborator for their kind offer to write this serial, and to Mr. W. S. Millard, for his welcome offer of assistance.

Ever since his retirement from India, 20 years ago, Mr. Millard has continued his intimate association with the Society by acting as the Society's representative in London. The work, implying as it does continuous dealings with the Society's printers and publishers in London, has involved considerable labour and sacrifice of time, which Mr. Millard has generously given to the Society. We take this opportunity of expressing to him the sincere thanks and appreciation of the Committee and Members of the Society.

In concluding this review of the Society's work during the year, we wish to express our thanks to all members who have contributed notes and articles to the *Journal.* By their co-operation they are continuing that fine tradition of voluntary help which has been the mainstay of the Society since it was founded more than half a century ago. The forty volumes of its *Journal,* and its magnificent collections have been brought into being almost exclusively by the generous, voluntary help of members. We hope that the Society will long continue to receive the benefit of such assistance and support. It is particularly in regard to the Journal that the co-operation of members is most needed. The Society's *Journal* has contributed immensely to the progress of Natural Science in India. This is only one aspect of its purpose. Equally important is the creation of a wider interest in and the spread of knowledge of Natural History. To succeed here the *Journal* must contain articles which are intelligible and attractive to the layman and the general reader. In the more spacious days of the past, there were many people in India, who made Natural History their hobby and who contributed their notes to the *Journal*, and there were many again who sent us interesting accounts of shikar and travel. More rigid conditions in India to-day are limiting time and leisure. Commercial periodicals and papers, which are in a position to pay well for popular contributions, have also entered into the field and have further limited the range of voluntary effort. Under these conditions, the Society is finding it difficulty to secure voluntary contributions of a *popular* nature for the *Journal.* We feel sure that there are many among our readers who could help us to make the *Journal* what we want it to be—more attractive and more interesting to the layman. The Society appeals to its members for this assistance and support. The *Journal* is what we, working together, can make it.

The Museum.—The New Natural History wing of the Prince of Wales Museum, where the Society's collections are housed, was opened to the public by H.E. Sir Roger Lumley, Governor of Bombay, on Thursday the 17th March. A private view of the galleries was arranged for members of the Society on the day previous to the opening.

In the design of the New Wing a special effort was made to provide for the more effective control of lighting and the more advantageous use of space. The windows are placed at a height of 8 feet above the floor level. This directs the volume of light from above and provides for its more even distribution. The superior position of the windows also leaves a continuous and unbroken wall space below them, thus providing the maximum exhibition area. Provision was also made in the design of the new galleries for several large electrically illuminated dioramas which are such an interesting and attractive feature in modern Natural History Museums. The new wing so far completed is but part of a larger plan for the Natural History Museum. It includes only the public galleries. The construction of that part of the building which is to house the research collection, laboratories, lecture room and library has been postponed till funds are available. The present entrance to the Natural History Section opens on to the Bird Gallery.

Colour Schemes.—The impression on entering is one of space, to which is added the pleasing effect of an attractive colour scheme. In this gallery the dark green of the show cases with their aluminium metal facings and the pale green of the walls produce an altogether restful and pleasing impression. There is nothing of that atmosphere of heaviness and artificiality so inseparable from many of the older museums. There is light, space and colour. Different colour schemes are introduced in each gallery. The object is always to present something fresh to the eye, to renew and maintain the interest of the visitor.

The use of mural paintings for the decoration of the walls is yet another development in modern museum technique. Apart from their purely decorative effect, the murals have a distinct educational value. They are a clear and simple means of transmitting ideas and stimulating interest. Large murals in the fish gallery illustrate the fishing industry in the Bombay Presidency and give an added interest and meaning to the exhibits below. Other murals depicting Pterodactyls, Great Sea Lizards, and Giant Dinosaurs call attention to past epochs when reptiles, unlike their puny descendants of our day, were dominant over the earth, the seas and the sky. In the bird gallery a beautiful mural showing wild duck flighting over a *jheel* strikes a charming and appropriate note. The murals are the work of Mr. A. Valeé and Mrs. Blundell (K. Nixon), who are to be congratulated on the skilful handling of the work.

Habitat Groups.—A feature of the galleries are several beautiful illuminated dioramas showing various animals, birds and reptiles in their natural environment. These groups are the finest expression of modern museum technique. Science and Art here combine to hold up the mirror to Nature. The modern museum group makes a strong appeal to the average visitor because it is concerned with life and the living animal; with something that is less abstract, and more likely to leave an abiding impression. The factor on which the modern museum group depends largely for its success is one which makes a universal appeal—a love of beauty is common to all and affords the simplest method of attracting attention, which is the preliminary to all successful instruction.

The groups in the Natural History galleries fulfil these objectives. Their beauty compels attention, while at the same time they give the visitor an intimate insight into the lives and habits of the creatures they portray.

Flamingoes nesting in the deserts of Cutch, Bearded Vultures in their Himalayan eerie, Bison in the Mysore Hills, Tiger in the forests of Assam, Spotted Deer and Black Buck, the loveliest of all deer and antelope, a Malay Python, a submarine group of Sharks, and Marine Turtles all are presented in these groups with vivid realism.

Shelves are not used anywhere in the Museum. They produce a monotonous lineal type of arrangement which can be altogether depressing. The various exhibits are fitted to the backgrounds of the show cases with small movable brackets. The system affords greater freedom of arrangement and offers a constant change to the eye and lends itself to a pleasing and attractive grouping of the exhibits. In the arrangement of the general collections the objective has always been not to confuse the visitor by presenting a multiplicity of forms. Typical representatives of the various families of animals, birds, reptiles and fishes are shown. Each family is illustrated with its typical genera and species and the visitor obtains a clear idea of the classification of these animals and the basis on which this classification is made. The habitat groups illustrating the lives and habits of various species, complete the picture and add interest and life to the story.

The labelling of the exhibits, a most important feature of museum work, is carried out in celophane and glass. The method provides a label which is attractive and yet resistant to discolouration and mottling. It is a new method in labelling, first introduced in the Natural History Galleries of this museum, and is now being adopted by museums abroad.

That all this work has been made possible is due largely to the material assistance given by the Bombay Natural History Society which through the agency of its members not only collected a sum of Rs. 23,000 towards the expenditure but also provided the specimens and exhibits. The present Government equally realizing the educational value of the work in addition to the ordinary grants, made a special grant to the Section of Rs. 10,000 in last year's budget and is providing an additional Rs. 7,500 in the budget for the current year.

The Natural History Galleries of the Museum represent the far reaching advance that has been made in modern museum methods. They set a standard and indicate what can be achieved by museums in this country. The advance has been made possible by the wise policy of the Society and the Trustees who deputed the Curator, Mr. S. H. Prater, to study museum methods in England, Europe and America. He has thus been enabled to introduce and adopt these methods to the progress of the museum movement in this country. Mr. Prater, has also been fortunate in having under him a most efficient staff. Particular mention must be made of Mr. C. McCann, whose indefatigable labour and skill have contributed so much to the success of the work, *Revenue Account.*—We are pleased to record a Surplus Revenue of Rs. 3,341-4-9 as compared with a deficit of Rs. 2,262-5-5 in 1937. Total income was Rs. 35,067-5-7 in 1938 as against Rs. 31,198-7-9 in 1937. The sum of Rs. 5,000 recovered from the Natural History Section, Prince of Wales Museum in 1938, gave a welcome fillip to our Finances, but it should be remembered that in 1937, we received Rs. 2,500 in Vice Patronship fees, so it will be seen that the position generally is definitely more healthy.

Subscriptions are up by about Rs. 400, the income from Game Books and from Bird Charts shows a welcome increase and the Tree Book brought in Rs. 2,107. This seems sufficient proof that expenditure on books of popular appeal is money well invested, and we hope to undertake publication of a popular bird book before the end of this year.

Expenditure.—This shows a small increase of Rs. 500 odd, accoutned for by the cost of Journals and increased postage charges.

General Charges show a decrease of Rs. 300 odd.

Membership.—The position on December 31, 1938, was as under :—

Resignations ...	... 51	
Unpaid subscribers ...	... 27	(since resigned)
Deaths ...	... 11	
	89	
New Members ...	... 46	(decrease 43)

Total Membership on 1st January, 1938 ...	929	
Total Membership on 1st January, 1939 ...	886	(decrease 43)

From the financial point of view, the Society is not affected by the 27 members who have not paid their subscriptions for the last three years.

The Committee have pleasure in announcing that His Exalted Highness the Nizam of Hyderabad has honoured the Society by becoming one of its Vice Patrons and wish to express their thanks for a contribution of Rs. 5,000 which H. E. H. made during the year to the funds of the Society.

Staff.—The Committee wish to record their appreciation of the good work done by the Curator and his staff during the past year.

P. M. D. SANDERSON,

April 1, 1939. *Honorary Secretary.*

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FORT, BOMBAY

BOMBAY NATURAL HISTORY SOCIETY.

BALANCE SHEET AS AT 31st DECEMBER 1938.

LIABILITIES	Rs A P	Rs A P
Life Membership fees:		51,625 0 0
Donations for specific purposes unexpended:		
Show Cases, Models of Fish, etc. in Prince of Wales Museum—Account No. 1 ...	1,096 10 7	
Show Cases, etc., in New Building, in Prince of Wales Museum—Account No. 2.	145 15 11	
Special Journal Fund	6,314 11 0	
Ornithological Survey	2,000 0 0	9,557 5 6
Sundry Creditors:		
Brig. W. H. Evans, Account Butterfly Books	147 8 10	
Messrs. John Bale Sons and Curnow, account Tree Book	322 4 5	
The Diocesan Press, Madras	1,900 0 0	
For Expenses (Audit Fee)	250 0 0	2,619 13 3
Donation from H E.H. Nizam for Expenses:		5,000 0 0
Surplus Assets:		
Balance as per last Balance Sheet ...	24,265 13 3	
Add.—Surplus on Revenue Account ...	3,341 4 9	27,607 2 0
Total ...		96,409 4 9

ASSETS	Rs A P	Rs A P
Investments—At holding value or Market value whichever is lower:—		
Rs. 35,000 3½% Loan 1947/50 at 102¼% ...	35,787 8 0	
,, 15,000 5% do. 1945-55 at par ...	15,000 0 0	
,, 10,000 3% do. 1951-54 at 98% ...	9,800 0 0	
,, 14,000 4% Bombay Port Trust Bonds at 77%	10,780 0 0	
,, 15,000 4 % Bombay Improvement Trust Bonds at 76%... ...	11,400 0 0	
,, 5,000 3½% Pro-Note 1854-55 (out of donation received from H. E. H, Nizam)	4,997 4 7	87,764 12 7
Rs. 94,000		
Cash—		
With National Bank of India, Ltd., Bombay, (inclusive of Rs. 2-11-5 out of donation received from H.E.H.Nizam.)	5,422 8 0	
With National Bank of India, Ltd., London, £25-11-5 at 1/6	340 15 1	
On hand	150 9 0	5,913 7 1
Sundry Debtors:		689 1 0
Advances to Staff:		235 0 0
Furniture:		
As per last Balance Sheet	1,552 0 0	
Less Depreciation	25 0 0	1,527 0 0
Publications excluding Journals: Stock on hand as certified by the Hon. Secretary		200 0 0
Game Books, Vol. III: Stock on hand as certified by the Hon. Secretary		80 0 1
Total ...		96,409 4 9

Note.—A stock of 20,500 old Journals and the valuable research collection and Library of 2,600 volumes have not been taken into account on the asset side of the Balance Sheet.

We have prepared the above Balance Sheet from the Cash Book and from the information given to us, and have verified the Investments.

In our opinion such Balance Sheet represents a true and correct view of the state of the Society's affairs according to the best of our information and the explanations given to us.

BOMBAY NATURAL HISTORY SOCIETY

REVENUE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1938.

Dr.	Rs A P	Rs A P	*Cr.*	Rs A P	Rs A P
To Salaries	18,976 0 0		By Subscriptions	20,036 7 9	
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,, Surplus carried to Balance Sheet ...		3,341 4 9			
Total ...		35,067 5 7	Total ...		35,067 5 7

PUBLICATION ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1938.

	Rs A P	Rs A P		Rs A P	Rs A P
To Stock of Game Books, Vol. III	357 0 1		By Sales of Game Books, Vol. III	277 0 0	
,, Expenses during the year	0 0 0	357 0 1	,, Stock on hand (31st December, 1938) ...	80 0 1	357 0 1

Dr. **Cr.**

INCOME AND EXPENDITURE ACCOUNT OF DONATIONS FOR SPECIFIC PURPOSES FOR THE YEAR ENDED 31st DECEMBER, 1938.

	Rs A P	Rs A P		Rs A P	Rs A P
Fund No. 1					
To Expenditure on Fish Gallery, etc. ...	288 4 0		By Unexpended Balance as per last Balance Sheet		1,384 14 7
,, Balance carried to Balance Sheet ...	1,096 10 7	1,384 14 7			
Show Cases Fund No. 2					
,, Expenditure on Show Cases in New Building	1,949 10 0		,, Unexpended Balance for Show Cases in New Building as per last Balance Sheet	....	
,, Balance carried to Balance Sheet ...	145 15 11	2,095 9 11			2,095 9 11
Special Journal Fund					
,, Expenditure on Journals	3,191 12 8		,, Unexpended balance (Special Journal Fund) as per last Balance Sheet ...	8,773 2 4	
,, Balance carried to Balance Sheet ...	6,314 11 0	9,506 7 8	,, Donations received during the year ...	733 5 4	9,506 7 8
Ornithological Survey					
,, Expenditure on Ornithological Survey ...	5,147 10 0		,, By Unexpended balance as per last Balance Sheet	1,619 9 3	
,, Balance carried to Balance Sheet ...	2,000 0 0	7.147 10 0	,, Donations received during the year ...	5,528 0 9	7,147 10 0

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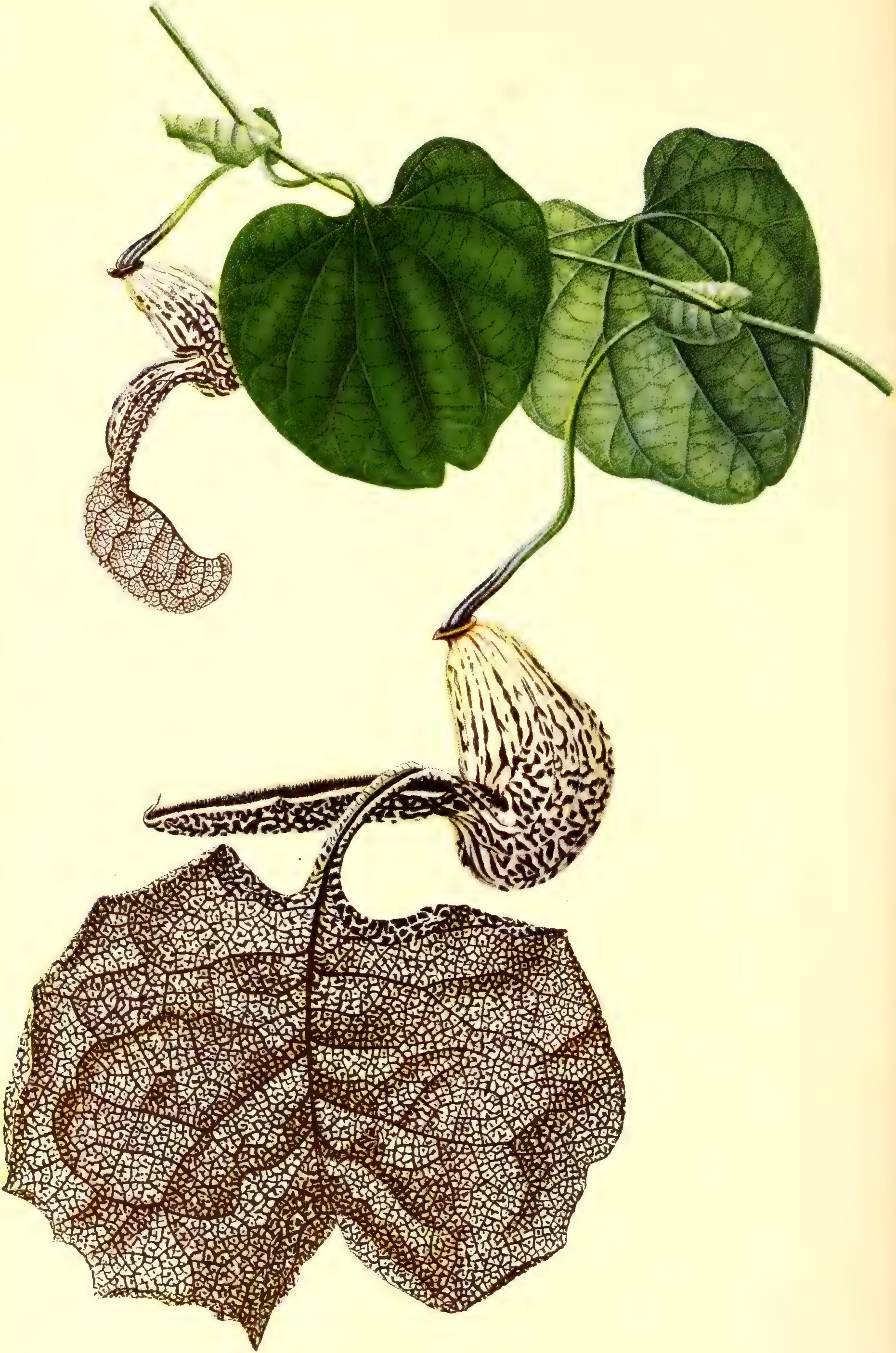

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Bird's-head Birthwort.
Aristolochia ornithocephala, Hook.
(½ nat. size)

JOURNAL
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1939. Vol. XLI. No. 2.

SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

N. L. Bor, M.A., D.SC., F.L.S., I.F.S.,

Forest Botanist,

AND

M. B. Raizada, M.SC.,

Assistant Botanist,

Forest Research Institute, Dehra Dun.

Part II.

(*With one coloured plate,* 3 *photographs and* 12 *text-figures*).

(*Continued from Vol.* xli, p. 11).

Aristolochia Linn.

Theophrastus, a Greek, sometimes known as the 'Father of Botany' gave this name to the plant now known as *Aristolochia pallida,* which was considered to be a valuable medicinal plant among the ancients. *Aristolochia* seems to be derived from two Greek words, *aristos*, 'best' and *locheia* 'birth'; the combination has reference to its supposed medicinal virtues in obstetric cases. The English name for the genus is Birthwort. It is known to the Germans as Osterluzei.

This genus comprises about 180 species, of which the very great majority are inhabitants of the tropics, especially in South America, while only a few are to be found wild in temperate climates. The species are, however, largely cultivated in the tropics outside their native homes, and are favourite hot house plants in the colder climates of the world.

MAR 1 1940

The species are grown as ornamental plants chiefly on account of their remarkable, often fantastic, flowers, but owing to the unpleasant odours which the flowers emit they are usually placed in the background. In systematic botany the genus is grouped with certain other families which also have extraordinary flowers and form a well defined cohort. Many of the species thus grouped together possess highly coloured, foetid flowers, some are insectivorous and others parasites. The families represent reduced and degraded forms and include some of the monstrosities of the plant world.

The species of this genus are almost always climbing plants arising from a perennial rhizome or root. The leaves are simple, alternate and petioled. In many species the organs possess secretory cells, which, in the case of a leaf held up to the light, are visible as translucent dots. The flowers are arranged in various ways and exhibit the oddest shapes. The flowers of some are small, while others are gigantic blooms swollen into a trumpet with a tail up to 4 feet long. Others again, like that figured in our plate, have a large expanded broad lip and a beak.

The colours of the flowers are those usually associated with the so-called indol group of scents, though to use the word 'scent' in connection with the flowers of *Aristolochia* is apt to give a wrong impression. The fact of the matter is that most of the flowers of this genus emit extremely offensive odours which apparently arise from the decomposition of albuminoid compounds developed in the perianth. Colours evolved in combination with such scents are those which one instinctively connects with decomposing carcasses. Maroon or purple, or livid spots, violet streaks and red brown veins on a greenish or fawn coloured background are the prevailing colour schemes. The general effect, however, is bizarre and eccentric, rather than beautiful.

It may be mentioned here that certain species which are entirely odourless to the human sense of smell, have been proved to emit scents which are attractive to insects.

The perianth is single, that is, it cannot be divided into calyx and corolla. In many respects it is similar to the spathe of the Arum Lilies, in that it consists of three distinct portions. The terminal segment, or lip, may be trumpet-shaped, or two-lipped, two-winged or expanded in various other ways. The central portion is tube-like with a wide or narrow orifice, the inner surface of which is usually covered with hinged hairs. The lower or basal portion is swollen into a bulb-like structure.

At the bottom of this bulb or pouch will be found a thick stylar column on the top of which are displayed the broad stigmas with downwardly-bent tips. A ring of linear anthers is fixed to the stylar column below the stigmas; the whole structure being called a gynostemium.

The devices adopted by plants to ensure cross-pollination are manifold and curious, but in the case of the genus *Aristolochia* they are so remarkable that they can only be described as astounding.

The researches of Petch at Peradeniya have thrown a good deal of light upon this process and have shown that although cross-fertilisation is the rule in the genus, some at least can be self-fertilised. The following description of the process of fertilisation in the genus may be taken, therefore, to be a general description and not to apply strictly to any particular species.

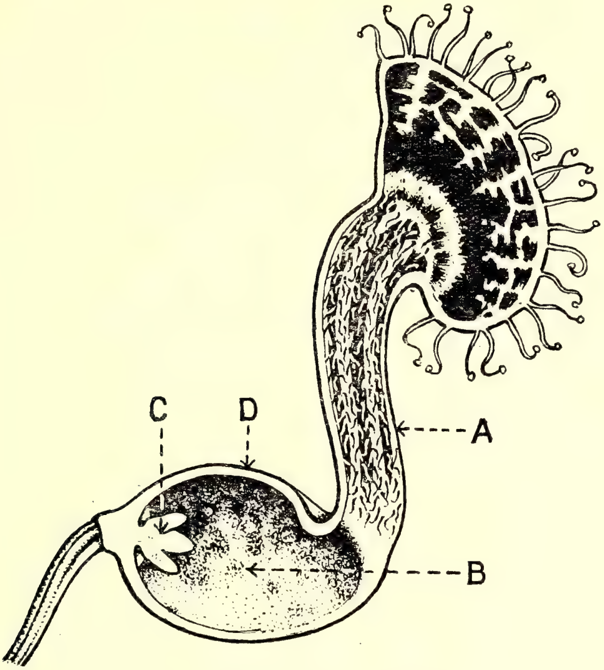


Fig. 1.—*Aristolochia ciliata* Hook.

A.—Tube with downwardly directed motile hairs.
B.—Grazing ground for insects.
C.—Gynostemium.
D.—Bulb.

The flowers of *Aristolochia* are termed by botanists dichogamous-protogynous, which means that in any particular flower the stigmas are receptive to pollen before the anthers in the same flower are ripe and ready to shed their pollen. The interval between the ripening of the stigmas and the shedding of pollen may be 24 hours or more.

From the description of the flower already given it will be realised that it is absolutely impossible for pollen to be transferred from one plant to another without the help of insects. Further owing to the position of the stamens below the stigmas, and to the fact that the anthers shed pollen after the stigmas are receptive, the casual visit of an insect, even though it may result in the fertilisation of the stigmas, does not ensure that the departing visitor will carry away pollen to fertilise another flower. A constant stream of insect visitors, from the moment the stigmas were receptive up to the shedding of the pollen, would probably ensure cross-pollination, but *Aristolochia* has improved upon this solution.

The problem before the flower is threefold; (1) insect visitors have to be attracted, (2) they must carry pollen from another plant, and (3) they must carry pollen away.

As regards the first part of the problem the species develop very highly coloured and conspicuous flowers which emit odours irresistible to insects. This combination of colour and odour makes success doubly sure.

As regards the second and third parts of the problem it will be observed that the solution of the third condition in respect of one flower means the solution of the second proviso in so far as another flower is concerned.

Aristolochia gets over the difficulty of the interval between the time the stigmas are receptive and the time the pollen is shed by developing a mechanism whereby an insect visitor is imprisoned. It accomplishes this unusual feat in the following manner.

When the stigmas are ready for fertilisation the lip expands into a perch or alighting platform. A visitor, usually a dipterous insect, arrives covered with pollen from an older flower and alights on the perch. Attracted by the mephitic odours from within it crawls down the tube. The interior of the tube is clothed with downwardly directed motile hairs which offer no impediment to the entrance of the insect. In some cases it has been observed that these motile hairs actually pitchfork the visitor down into the tube. Generally speaking, however, such 'strong-arm work' is not necessary and the insect makes its way into the bulb without compulsion. Once inside, it cannot escape because the hairs of the tube form a very efficient barrier.

In any case, the insect does not particularly want to escape for not only does the bulb provide 'lodging', it also provides 'board' in the shape of special areas of nutritious cells. Moreover, most bulbs have a window in the wall, formed of thinner layers of cells, and it is at this translucent spot that the prisoners congregate. The window is cunningly situated so that when the anthers dehisce the insects are drenched with pollen.

Any pollen brought by the visitors will be transferred to the receptive stigmas. Once the transference takes place the tips turn upwards and press the stigmatic surfaces together in order to prevent self fertilisation. The anthers develop rapidly and dehisce, covering the insects with pollen.

The hairs in the tube now begin to wither and shrivel up and the prison doors are thrown wide open. The insect, bearing its load of pollen, crawls out and, undaunted by its previous experience, flies to a flower which has just opened and repeats its performance. After the emergence of the insect, the fertilised flower closes and the perianth withers.

Obviously the first flower to open will not be fertilised because it cannot be visited by pollen bearing insects. If fertilisation does not take place the flower goes through the same cycle of changes;

the stigmas wither and turn upwards, the anthers dehisce and shed their pollen, the imprisoned insects are released and the problem of cross-fertilisation is solved.

The various organs of these climbers, especially the rhizome, have long been known to possess medicinal properties. Pliny and Dioscorides described several species and recommended their use for various complaints. Most of the older herbals contain references to the therapeutic properties of the roots and leaves.

The roots of *A. indica* Linn. and *A. bracteata* Retz are sold in the bazaars of India. The former has a great reputation in this country as an antidote to snake-bite. It is recommended that the juice of the fresh leaves be applied immediately to the bites of snakes and scorpions. The root is also used in intermittent fevers as an emmenagogue and tonic and is recommended for all kinds of intestinal disorders. Decoctions of the roots of several species are reputed to have anthelmintic properties. An *Aristolochia* of South America is said to be used as an arrow poison, probably in conjunction with the juice of other plants.

KEY TO THE SPECIES.

Flowers tailed.

- Flowers very large, with large trumpet-shaped lip; leaves not lobed ... ... *A. grandiflora.*
- Flowers medium sized; leaves three-lobed ... ... *A. macroura.*

Flowers not tailed.

- Corolla expanded into a large kidney-shaped lip with purple reticulations ... ... *A. ornithocephala.*
- Corolla not expanded into a flat lip.
  - Leaves acute at the tip, not orbicular or heart-shaped.
    - Leaves ovate-lanceolate with a sinus at the base ... *A. roxburghiana.*
    - Leaves oblong or fiddle-shaped; base cuneate ... *A. indica.*
  - Leaves rounded at the tip, orbicular or heart-shaped.
    - Flowers 5 in. long and over with a conspicuous beak and narrow lip ... ... *A. ringens.*
    - Flowers without a conspicuous lip and beak. Much less than 5 in. long.
      - Leaves orbicular.
        - Stems hairy. Flowers expanded into two finger-like processes which are covered with stalked glands ... ... *A. ridicula.*
        - Stems glabrous. Flowers not expanded as above; margin furnished with fleshy narrow processes. *A. ciliata.*
      - Leaves cordate-obtuse.
        - Whole plant hairy. *A. tomentosa.*
        - Whole plant glabrous.
          - Flowers inconspicuous, lip dark purple about 1-1.5 in. long ... . *A. bracteata.*
          - Flowers conspicuous, lip broadly expanded up to 3 in. long, variegated with yellow and purple ... ... *A. elegans.*

Aristolochia grandiflora Sw.

Pelican-flower or Poison Hog-meat.

(*grandiflora* means large-flowered).

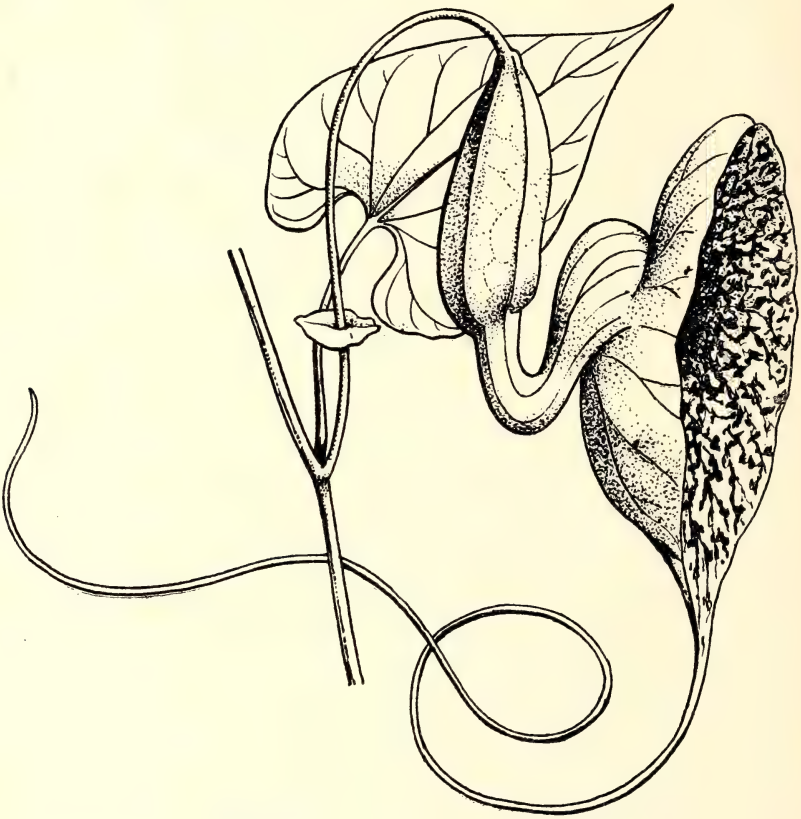
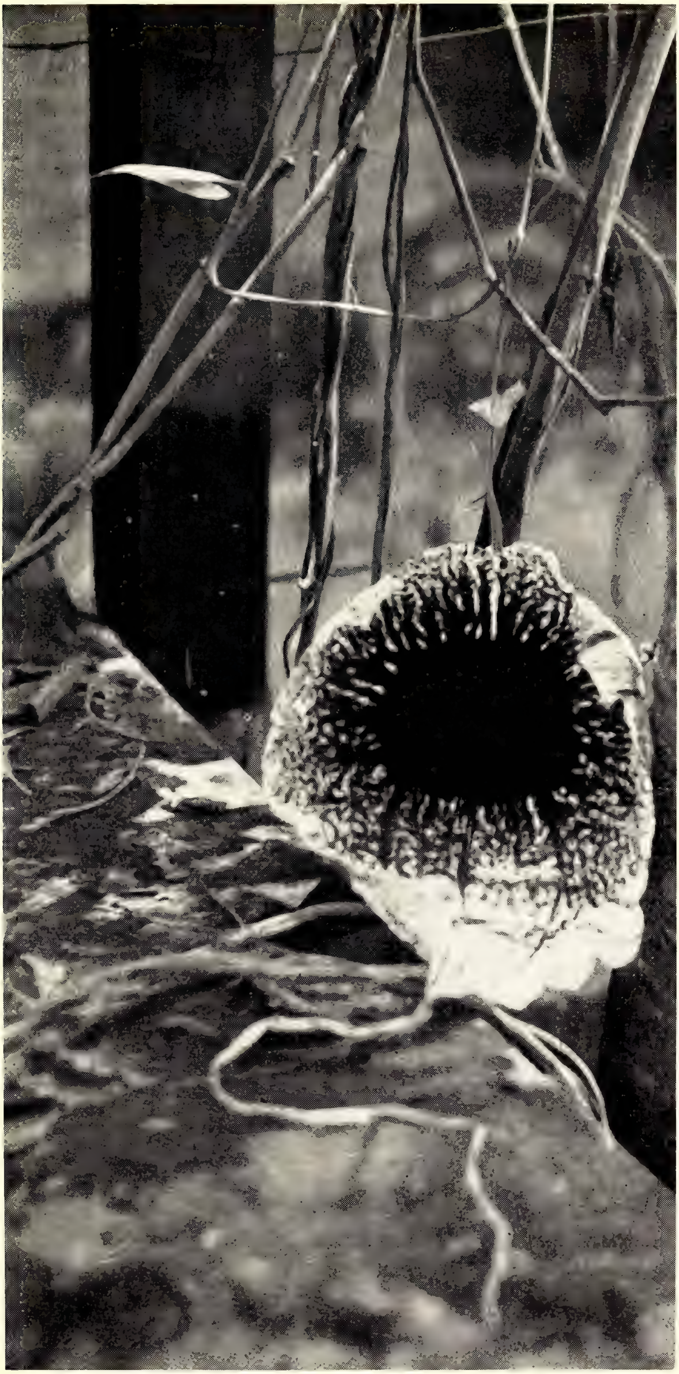


Fig. 2.—*Aristolochia grandiflora* Sw.

Description.—A shrubby climber. Leaves alternate on rather long petioles, cordate-acuminate, softly hairy. Flowers solitary on leaf-opposed peduncles; when in bud resembling a pelican's head in shape. There is a leafy bract at the top of the peduncle at the point where it joins the ovary; stalk and ovary hang vertically. The bulb is roughly hexagonal in section with reinforced angles, somewhat ovate in shape, about 4 in. long, slightly narrowed into a tube which bends sharply upwards. The posterior wall of the tube expands into a hood which is pressed back upon the bulb. The interior wall forms the lip, while the hood already formed bends backwards and expands into a large limb or face which may be 1 ft. across, roughly cordate in shape, slightly concave, narrowing to a thin flattened appendage up to 4 ft. long. The exterior of the flower is greenish-white or pale yellowish-white



The Pelican Flower (*Aristolochia grandiflora* Sw. var. *Sturtevantii*).

in colour covered with a network of pale purple-red veins. The flanges of the bulb are strongly marked with purple veins. The mouth and inner hood are deep reddish-purple in colour, while the face is greenish- or yellowish-white, streaked with broad, radial, somewhat mottled, reddish-purple bands with anastomosing branches. The odour of the flower is so offensive as almost to beggar description and for this reason it is best planted away from human habitations. Fruit a strongly-ribbed 6-valved capsule, 3 in. long, oblong in shape.

Flowers.—October—November. *Fruits.*—Cold season.

Distribution.—A native of Guatemala; but now cultivated in all warm countries in the open, and under glass in temperate regions of the world.

Gardening.—A very extensive climber suitable for growing over large structures but best kept in the background on account of its offensive odour. Can be raised from seed but also grows well from cuttings of well-matured wood. Var. *Sturtevantii* is the most commonly cultivated variety of the plant.

Aristolochia macroura Gomez.

Livid-flowered Birthwort.

Description.—A perennial climber. Leaves reniform, cordate, deeply 3-lobed, or almost 3-partite, the lobes ovate-oblong, obtuse. Petiole 1.5-2 in. long, rounded; stipules leaf-like, large, somewhat cordate, acute, wavy. Pedicels solitary axillary, much curved upwards. Bulb ovate, 6-ribbed, narrowed at the apex into the tube which is curved back upon the bulb. The tube is narrow below and gradually widens into a mouth. The posterior portion of the tube ends abruptly in a truncated waved lip; the anterior wall expands suddenly into a broadly cordate lip

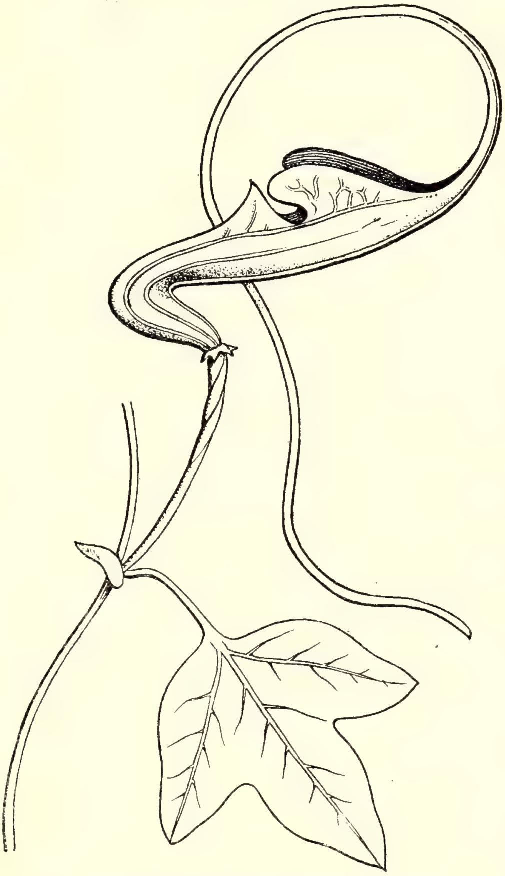


Fig. 3.—*Aristolochia macroura* Gomez.

which is abruptly attenuated into a slender twisted tail which may reach 18 in. in length. Tube and bulb dingy brownish-green in colour, ribs purplish, the intervening spaces covered with a coarse purplish network of veins. Lip and tail of a rich blackish-brown or deep purple colour. Fruit a 6-valved capsule.

Flowers.—Rainy season. *Fruits.*—November.

Distribution.—A native of Brazil, now cultivated in gardens throughout the world on account of its striking flowers.

Gardening.—The length of the tail and the smaller upper lip in relation to the tube of the corolla is characteristic of this species. It bears its peculiar, fascinating flowers in great profusion during the rains. Easily raised from seed sown in early spring.

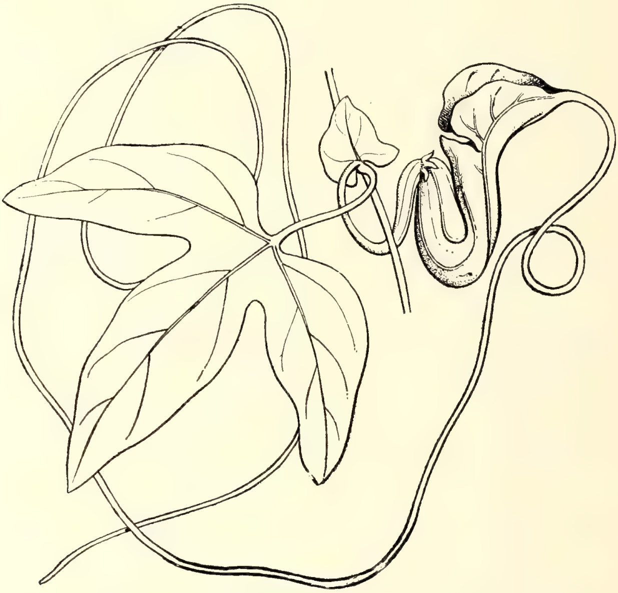


Fig. 4.—*Aristolochia macroura* Gomez.

(Showing deeply partite leaves and very long tail.)

Aristolochia ornithocephala Hook. (**Aristolochia brasiliensis** Mart. et Zucc.).

The Birdshead Birthwort.

(The specific name is derived from two Greek words, *ornithos* bird, *kephale* head, and refers to the peculiar shape of the perianth which resembles the head of a bird).

Description.—An extensive climbing shrub with large, alternate, long-petioled, cordate, reniform (kidney-shaped) leaves which have a broad and deep sinus at the base. At the junction of petiole and stem may be observed the foliaceous, glaucous, embracing stipules. The flowers are solitary and are borne on peduncles 8-10 in. long. The perianth is single, corolla-like and can be divided

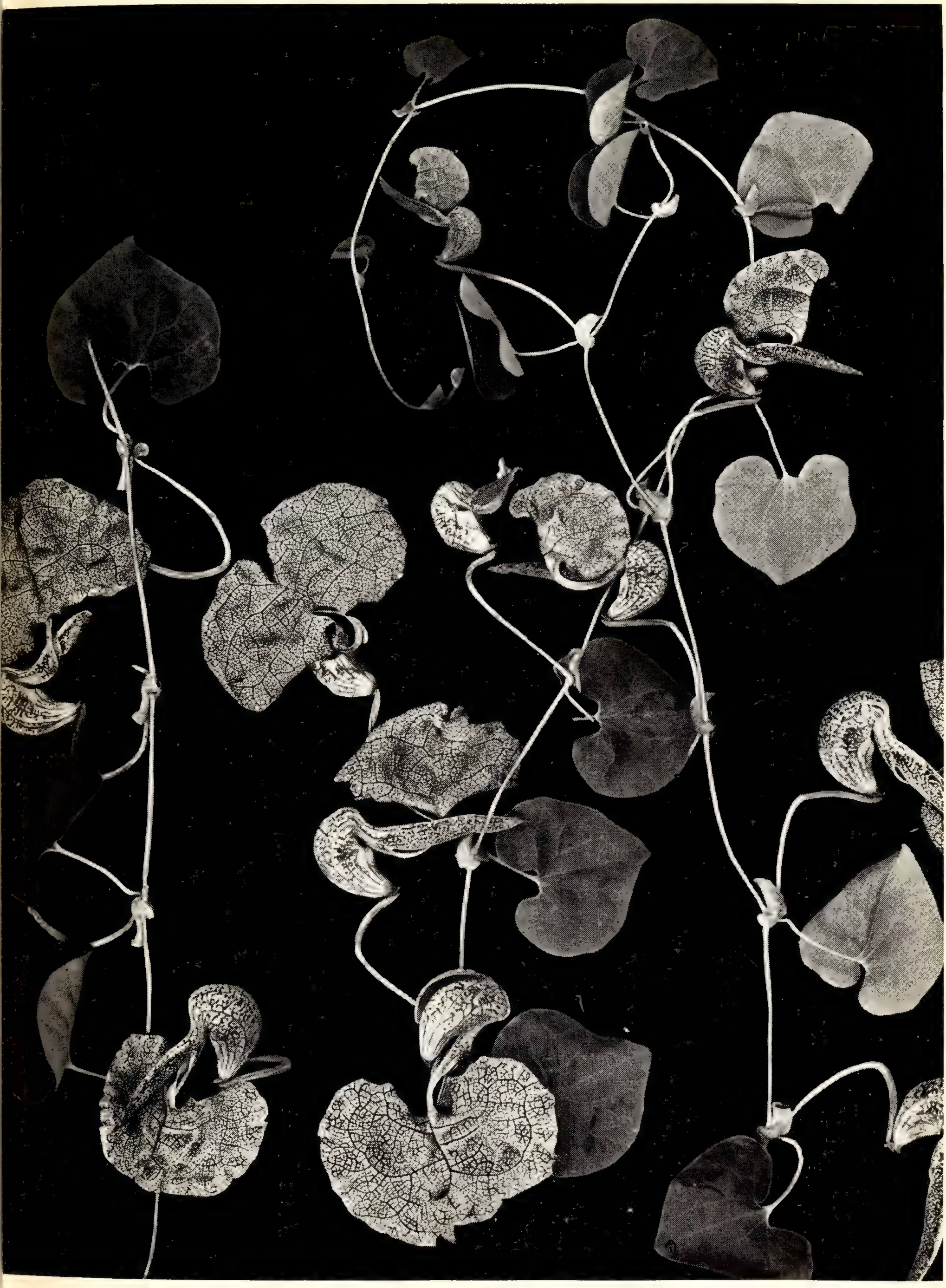


Photo by M. N. Bakshi.

The Bird's-head Birthwort (*Aristolochia ornithocephala* Hook.)
New Forest, Dehra Dun.

into three parts. The lower globose part or pouch contains the stylar column, stigmas and stamens. The tube (2.9 in. long) is suddenly inflated in the upper quarter into the so-called bird's head. Attached to the head are two expansions which may be termed beak and lip. The beak which is uppermost in the flower is lanceolate in shape but the margins are rolled inwards on the hairy inner surface, and the whole structure is curved downwards, greatly resembling the beak of a bird. The lip is attached to the lower margin of the tube by a grooved stalk which may reach 2 in. in length. The lip itself is broadly reniform in shape and is 6 in. long by 4 in. broad. The pouch and tube are often dark shining purple in colour. The ground colour of the lip and beak may be dirty white, dingy-yellow or greyish-fawn and on this background is traced a most intricate pattern of purple reticulations, giving a very striking and curious effect. The stamens are six in number and are attached in the usual way to the six-toothed stylar column. Fruit a six-valved capsule containing numerous flat seeds.

Flowers.—Rainy season. *Fruits.*—December-January.

Distribution.—A native of Brazil, but now commonly cultivated in all warm and temperate regions of the world.

Gardening.—This plant is easily propagated from cuttings of well matured wood, which should be taken in spring. It can also be raised from seed which must be sown thickly to ensure good germination. As this plant is an extensive climber it can be trained along walls or over trellises. In Dehra Dun it does not emit an offensive odour and so may be used to cover the walls of dwelling houses.

Aristolochia roxburghiana Klotz. (**A. tagala** Cham.).

Description.—A stout, lofty climber; with grooved, glabrous stems. Leaves 3-10 in. long, lanceolate to lanceolate-ovate; upper 2-3 in., lower 3-5 in. broad; broadest at the cordate base, usually with a deep and narrow sinus, reticulately veined, glabrous; petiole twining. Flowers numerous, in loose, slightly hairy racemes, mostly abortive, usually only one fertile; bracts small, oblong. Perianth 2-2.5 in. long, pale green in colour, base globose, tube curved, mouth oblique; lip straight, linear, obtuse, villous, as long as the tube. Capsule 1-2.5 in. long including the stalk, 6-valved, pear-shaped, globose or oblong-ellipsoid, transversely ridged, glabrous, splitting into six portions each of which is held suspended on a thread like portion of the peduncle which also splits into six parts. Seeds broadly ovate-deltoid with a deep membranous wing, flattened, usually tuberculate on one face, .2-.4 in. broad.

Flowers.—April-May. *Fruits.*—May-June.

Distribution.—Indigenous to India and Burma, extending to Malaysia.

Gardening.—This evergreen twiner has small and inconspicuous flowers but its heavy and rapid growth of foliage renders it suitable for growing over unsightly buildings. It is not particular in its demands as regards site or situation and is easily raised from seed sown in March or at the break of the rains.

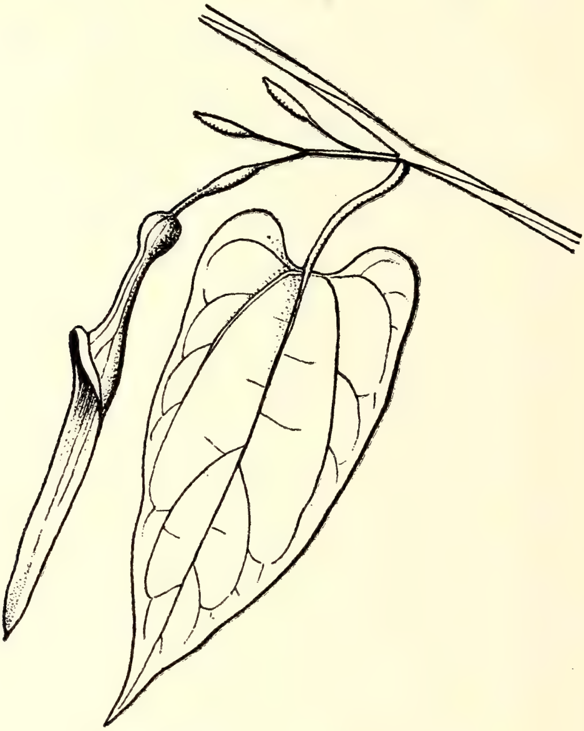


Fig. 5.—*Aristolochia roxburghiana* Klotz.

Aristolochia indica L.

Description.—A glabrous, shrubby or herbaceous perennial arising from a woody rootstock. Branches long, slender, grooved, glabrous. Leaves variable, fiddle-shaped to linear, 2-4 in. long, 1-2 in. broad, 3- to 5-nerved at the base, somewhat cordate, acuminate, glabrous with a slightly undulate margin.

Flowers in few-flowered axillary racemes; bracts small, ovate, acuminate. Pedicles long, thickened above. Perianth .7-1.5 in. long, with a glabrous inflated and lobed base, which is suddenly narrowed into a cylindric tube about .5 in. long. The tube expands above and terminates in a horizontal funnel-shaped mouth, which is produced on one edge into a narrow, linear-oblong, obtuse lip with revolute margins. Both bulb and tube are pale green on the outer surface. The rim of the mouth is dark purple in colour. The upper surface of the lip is a livid brown and the lower surface dark purple. The purple areas on the mouth and lip are clothed with purple, hinged hairs. Inside the bulb are well-defined food

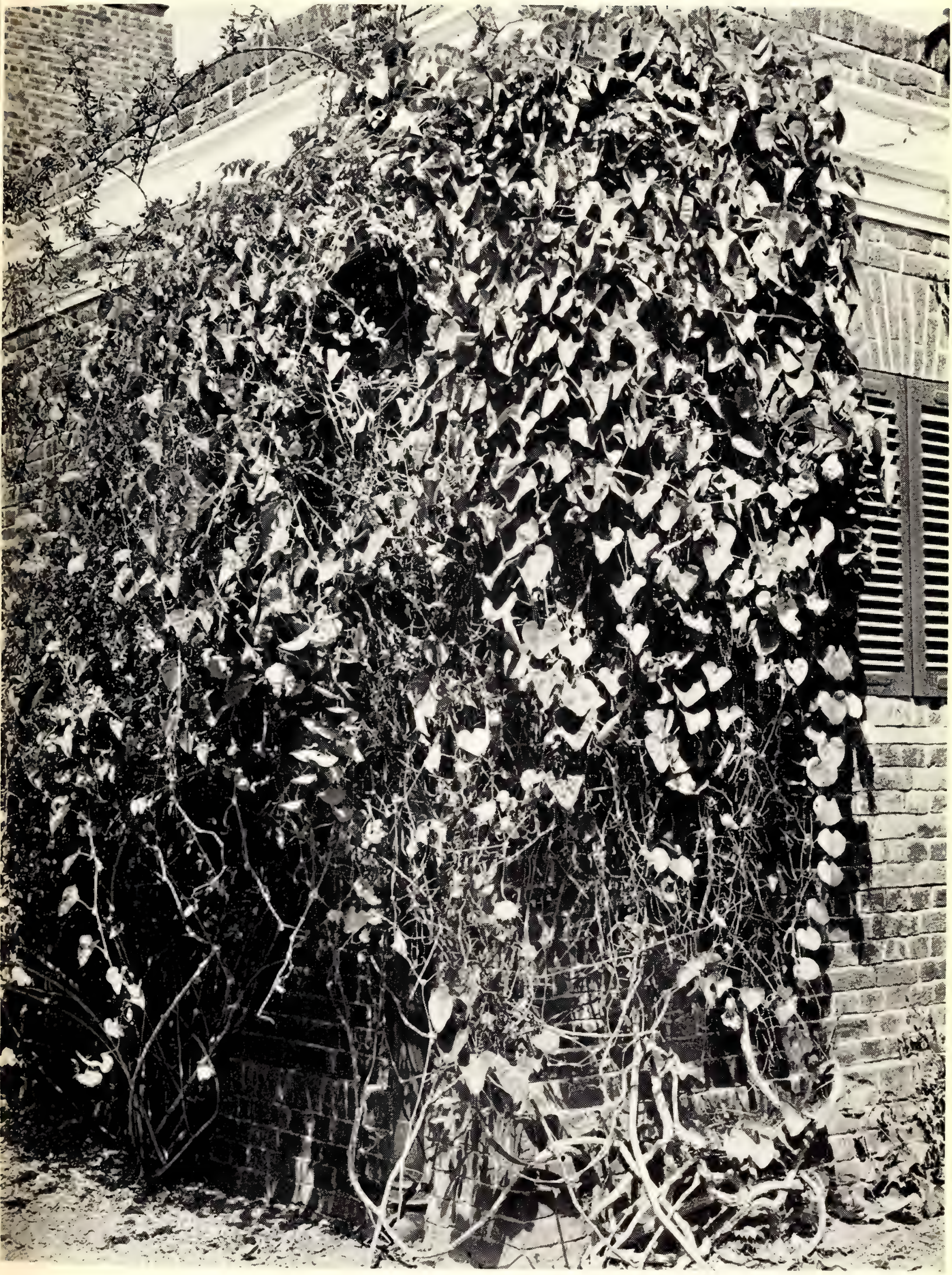


Photo by M. N. Bakshi.

The Bird's-head Birthwort (*Aristolochia ornithocephala* Hook.)
New Forest, Dehra Dun.

areas. Anthers 6. Stigmatic lobes 6. Capsule 1.5-2 in. long, sub-globose, or broadly oblong, 6-valved. Seeds flat, ovate, winged. The capsule splits up into six portions each of which is suspended from a filament-like part of the peduncle which also splits into six sections.

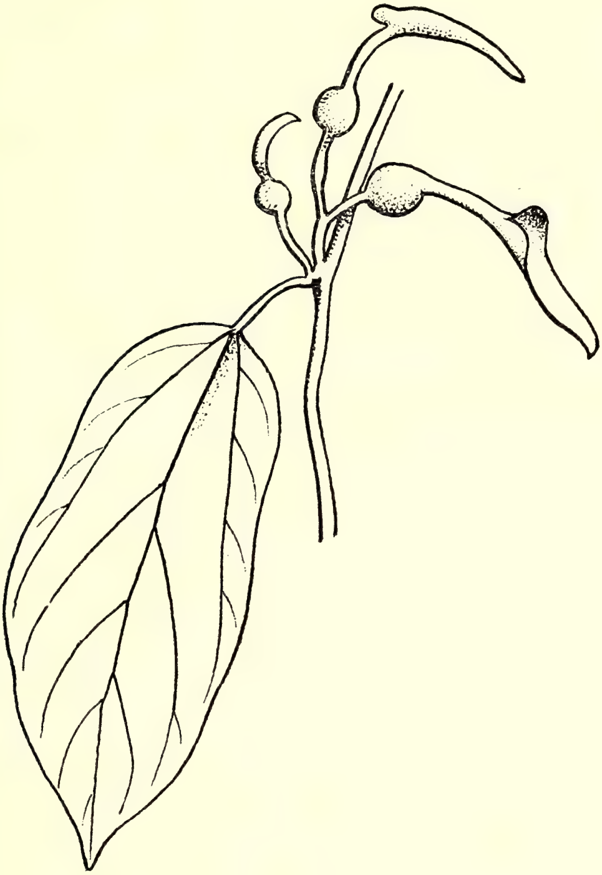


Fig. 6.—*Aristolochia indica* L.

Flowers.—June-October. *Fruits.*—November-March, but the parachute-like old capsules may be found up to the end of the hot weather.

Distribution.—Throughout the low hills and plains of India from Nepal and lower Bengal to Chittagong, and in the Deccan Peninsula from the Concan southwards. Common in Ceylon up to 3,000 ft.

Gardening.—This deciduous herbaceous or perennial twiner sometimes dies back to the root. It has inconspicuous, small flowers and is not at all showy. According to Roxburgh the root is nauseously bitter. The plant is supposed by the natives to ward off snakes and to be an antidote for snake-bite. This belief is probably founded on the resemblance which the flower bears to the head of a serpent and is interesting, in as much as several species of this genus enjoy a similar reputation in both North and South America, the Philippine Islands, and elsewhere. It is usually raised from seed. The flowers of this plant have no appreciable smell unless bruised.

Aristolochia ringens Vahl.

(*ringens* means snarling in Latin and refers to the gaping flowers).

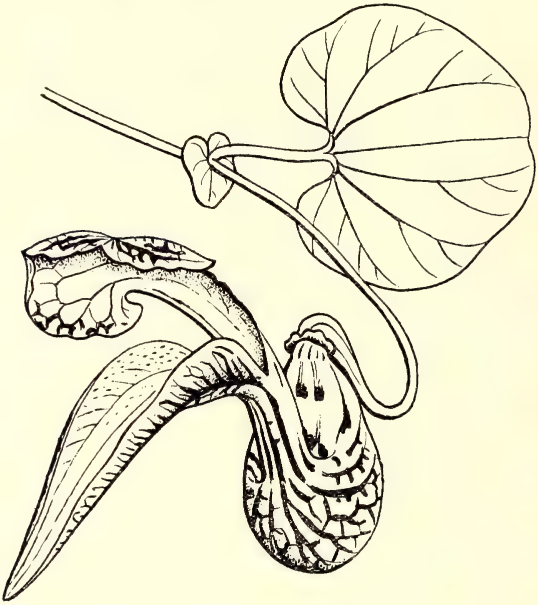


Fig. 7.—*Aristolochia ringens* Vahl.

Description.—A tall, glabrous, slender twiner. Leaves petioled, round reniform, pale green above, glaucous beneath, digitately 5-7-nerved at the base. Stipules foliaceous, very deeply two-lobed, kidney-shaped. Peduncle slender, four times as long as the petiole. Flowers 7-10 in. long, green, marked with dark-purple. Perianth with an obovoid ventricose sack 2.5 in. long, woolly inside; tube ascending obliquely from the sack, round, dividing into two very long lips. Upper lip (actually the lower for the flower hangs upside down) oblong-lanceolate, obtuse, concave, recurved, hairy inside from below the middle or hairy up to the edge; lower shorter, spathulate; claw long with recurved margins, blade broadly ovate or orbicular or almost kidney-shaped. Stamens 6, equidistant on the almost sessile stylar column. Ovary slender, twisted, grooved, expanded at the apex into a dark purple, callous disk.

Flowers.—November-December. *Fruits.*—Cold season, *Distribution.*—A native of Brazil, but now in cultivation throughout the tropics.

Gardening.—Like other members of this genus it can easily be raised from seeds sown in spring or by cuttings or root suckers. It generally prefers a cool, sheltered situation at Dehra. It is suitable for growing over trellis-work.

The roots of this striking plant are esteemed as an antidote for snake bites in New Granuda, where it is known as 'Guaco', from which place it was first introduced, according to J. D. Hooker, into the Royal Botanic Gardens, Kew.

Aristolochia ridicula N. E. Brown.

(The specific epithet is the Latin word, *ridiculus,* signifying 'droll' and refers to the peculiar shape of the corolla).

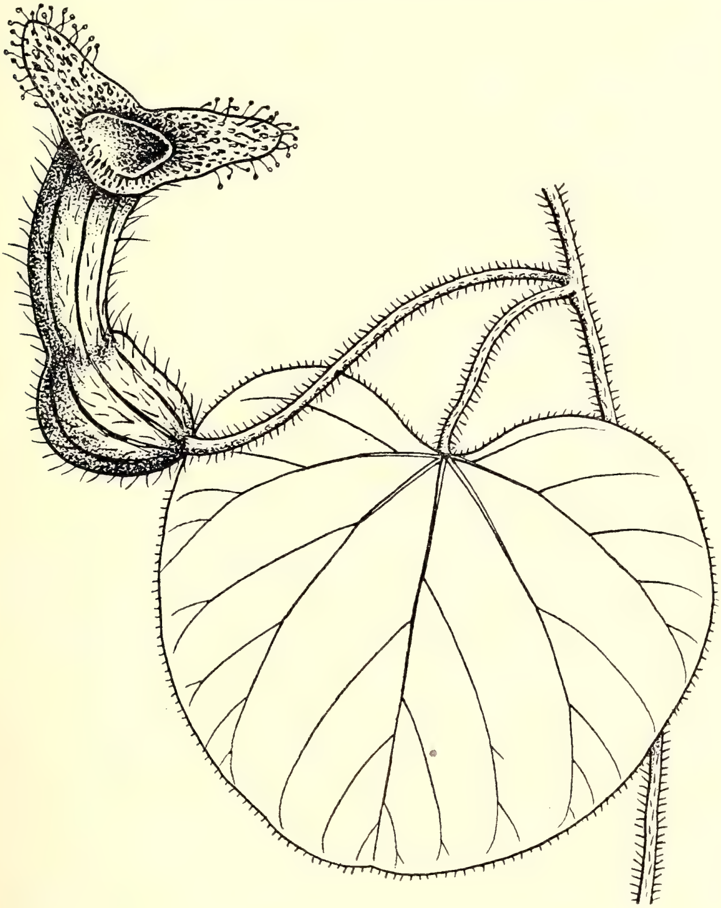


Fig. 8.—*Aristolochia ridicula* N. E. Brown.

Description.—A very slender climbing shrub, covered all over with spreading long stiff hairs. Leaves alternate, borne upon a petiole 1-2 in. long, membranous, very broadly ovate-cordate or almost round in shape, very obtuse at the apex, bright green above, paler beneath; veins very prominent on the lower surface, hairy. Stipules leaf-like, recurved. Flowers axillary, solitary, striking. Pouch at the base about 1 in. long, obliquely-ellipsoid in shape contracted at its upper end into a tube about 1 in. long, the latter gradually increasing in diameter from below upwards. Pouch and tube with a ground colour of pale yellow upon which are traced longitudinal veins of dull-brown-purple with anastomosing veinlets. The limb or lip, which is the expanded portion of the tube, is recurved at the margins and is extended dorsally into two widely-spreading linear obtuse lobes 1 in. long by .5 in. broad, bright yellow, spotted with reddish-purple, in colour; lobes sparsely covered with stalked, club-shaped glandular hairs. The mouth and throat of the tube are filled with deflexed white hairs. Stylar column short, with six obtuse stigmatic lobes, and six linear anthers.

Flowers.—Rainy season. *Fruits.*—Cold season.

Distribution.—This grotesque looking plant is a native of Brazil, but is now cultivated throughout the world.

Gardening.—Like its allies it is suitable for culture in cool and protected places or in conservatories. Easily raised from seed, suckers or cuttings.

Aristolochia ciliata Hook. (**A. fimbriata** Cham.).

Fringe-flowered Aristolochia.

(*ciliata* refers to the margins of the flowers).

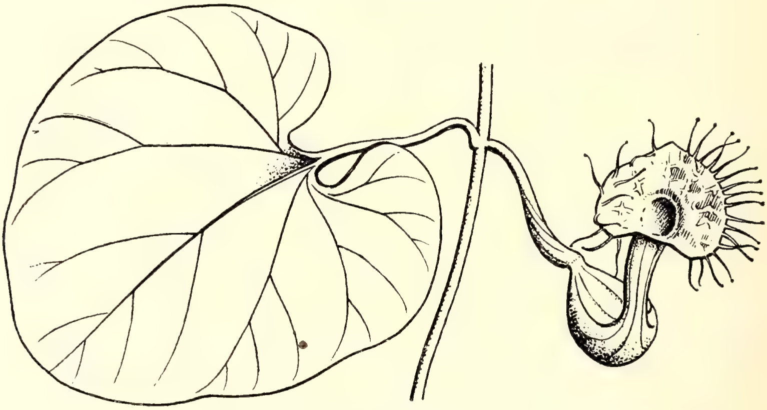


Fig. 9.—*Aristolochia ciliata* Hook.

Description.—A weak, slender, straggling plant. Leaves cordate-reniform, very obtuse, with a deep sinus at the base, pale beneath; petioles 1-1.5 in. long. Flowers solitary on peduncles which are shorter than the petioles. Bulb pear-shaped, constricted into the tube which is bent back upon it. The tube suddenly expands at the mouth into a kidney-shaped or broadly-ovate lip. Bulb, tube and underside of lip pale green or greenish-brown with darker green lines and reticulations. The ground colour of the lip is deep purple or chocolate upon which is traced a pattern of yellow bands which more or less correspond to the veins. The margin of the lip is fringed with yellow, purple tipped, fleshy processes about .3 in. long. The wall of the bulb is woolly internally, pale green in colour with a few purple spots. The window area is well-defined. Gynostemium thick, fleshy, divided into 6 lobes at the top. Anthers linear, sessile on the stylar column. Fruit a 6-valved capsule containing numerous flat seeds.

Flowers.—September-October. *Fruits.*—Cold season.

Distribution.—A native of Buenos Ayres, now commonly grown in greenhouses throughout the tropical and temperate regions of the globe.

Gardening.—The fringed, peculiarly shaped and coloured flowers render this species worthy of cultivation in greenhouses and cool, shady situations, particularly as the flowers themselves have no particularly offensive odour, although the whole plant has a rank smell. It is easily raised from seeds sown in April.

Aristolochia tomentosa Sims.

The Hairy Birthwort.

(*tomentosa* means hairy).

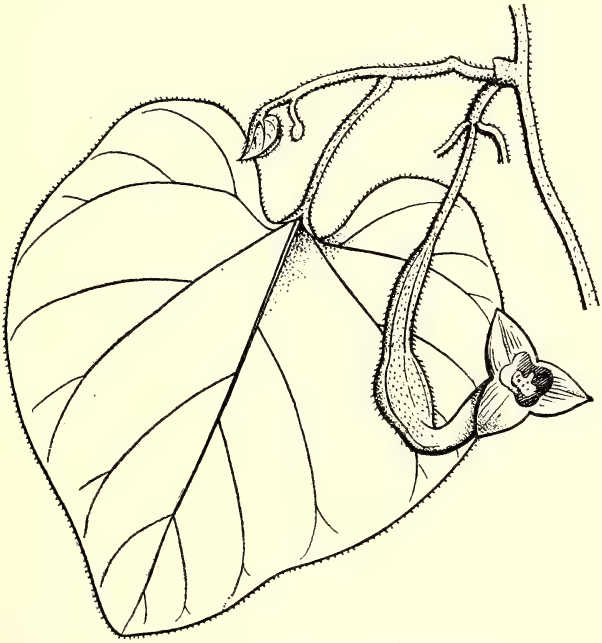


Fig. 10.—*Aristolochia tomentosa* Sims.

Description.—A tall woody climber, hairy all over. Leaves leathery in texture, rounded, cordate at the base, tomentose, 4-7 in. long, and as much across. Flowers solitary or 2 or 3 together in the axil of a leaf. Bulb pear-shaped constricted into a narrow tube which is bent back upon the bulb. The tube expands above into a lip which is extended into three reflexed triangular obtuse lobes. The bulb, tube and lower surface of the lobes are yellow or yellowish green. The lobes themselves are greenish-purple with a dark brown centre. Bracts absent. Stamens six, short, adnate to the stylar column. Fruit a 6-valved capsule; seeds numerous, flat.

Flowers.—May-June. *Fruits.*—Cold season.

Distribution.—Indigenous to North America (California to Illinois), now commonly grown in gardens throughout the tropical and subtropical regions of the world.

Gardening.—This plant is quite hardy in India, and will grow to a great height if properly supported. It can be grown with great ease over trellisses and arbours and its profuse foliage renders it particularly useful in hiding unsightly objects. The flowers are rather inconspicuous amid the mass of luxuriant foliage but they are rather curious in appearance and the plant is well worth cultivating in gardens. The root and bark are said to possess an aromatic flavour. The plant is said to have been first sent to England from Philadelphia in 1763.

Aristolochia bracteata Retz.

The Bracteated Birthwort.

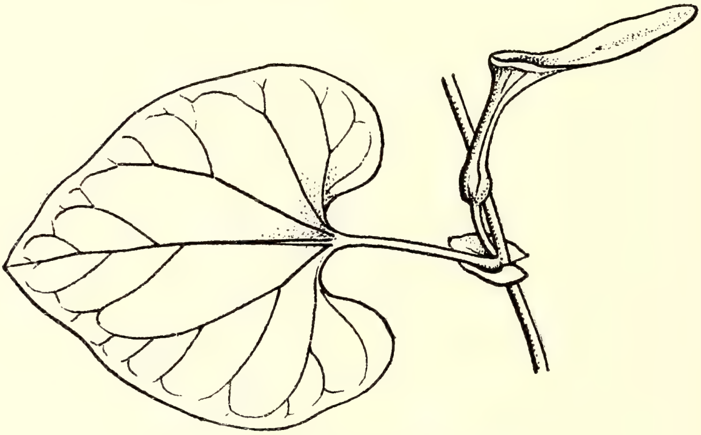


Fig. 11.—*Aristolochia bracteata* Retz.

Description.—A slender perennial herb; stems 12-18 in. long, weak, prostrate, branched, glabrous, striate. Leaves 1.5-3 in. long and as much across, reniform or broadly ovate, usually widely and shallowly cordate at the base, glaucous beneath, finely reticulately veined, glabrous; petiole .5-1.2 in. long. Flowers solitary; pedicels with a large sessile orbicular or subreniform bract at the base. Perianth 1-1.9 in. long, base sub-globose; tube cylindric, with a trumpet-shaped mouth, villous within with purple hairs;

lip as long as the tube, linear, dark-purple, margins revolute. Capsule .9-1 in. long, oblong-ellipsoid, 12-ribbed, glabrous. Seed .3 in. long, deltoid with a slightly cordate base.

Flowers.—At the end of the rainy season.

Distribution.—Upper Gangetic Plain, Bengal, Western Peninsula, Ceylon, extending to Arabia and tropical Africa.

Gardening.—This species has very small, inconspicuous flowers and is not worthy of cultivation but is valued for its medicinal properties which are extensively prescribed in Ayurveda. Decoctions of the plant are purgative, anthelmintic, and are said to be useful in the treatment of 'kapha', fevers and painful joints. The juice is applied to sores to kill maggots (hence the vernacular name kera-mar).

According to Kirtikar and Basu the extremely bitter taste of the plant persists for a long time, chiefly in the throat. Mhaskar and Caius repudiate its supposed medicinal virtues as an antidote to snake-venom.

Commonly raised by seed sown in early spring.

Aristolochia elegans Mast.

Calico Flower.

(*elegans* means graceful in Latin).

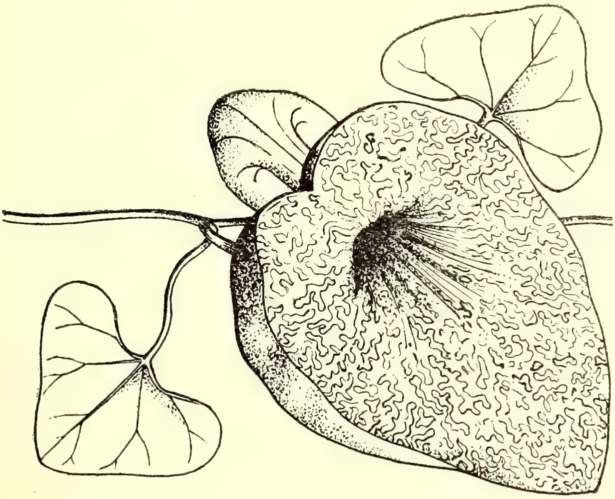


Fig. 12.—*Aristolochia elegans* Mast.

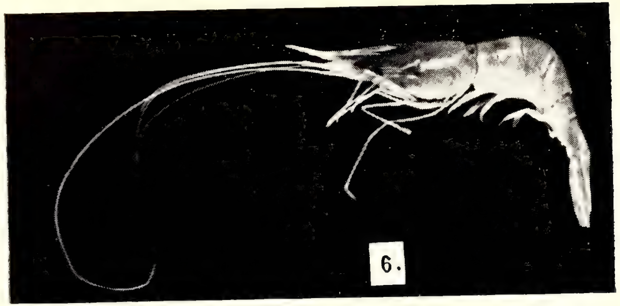
Description.—A very slender glabrous climber with pendulous branches and foliage. Leaves 2-3 in. long, and as much broad, borne on long (1-2.5 in.) petioles, very broadly ovate-cordate in shape, with a wide sinus and rounded lobes at the base, obtuse or rounded at the tip; bright green on the upper surface, somewhat glaucous beneath. Stipules leaf-like, curved. Flowers solitary seated on long pedicels. Perianth-pouch pale yellow-green in colour, swollen, contracted at the mouth into the narrow tube which is bent back sharply and lies upon the sack. Tube somewhat funnel-shaped at the top, expanding abruptly into a nearly circular shallow cup, cordate at the base, and about 3 in. in diameter. Outside the cup is whitish in colour covered with a network of red purple veins; inside the ground colour is a deep rich purple brown; becoming yellowish-green and velvety at the mouth and white towards the margins where the purple flows into the white in irregular patches. Stylar column short, cylindrical, expanded upwards into six oblong-obtuse lobes; anthers six. Fruit a capsule with innumerable flat seeds.

Flowers.—Rains. *Fruits.*—Cold season.

Distribution.—This plant is a native of Rio de Janeiro in Brazil, but is now commonly cultivated throughout the tropical and temperate regions of the globe.

Gardening.—It is a rather small-flowered, graceful species and a most desirable climber for a greenhouse. The hanging basket-like fruits are very attractive. Easily raised from seed which is freely produced under cultivation and usually flowers in the very first year. It can also be propagated by cuttings, layers or suckers. It is entirely devoid of the unpleasant odour which is characteristic of the flowers of this genus. In Florida it reproduces itself freely.

(To be continued).



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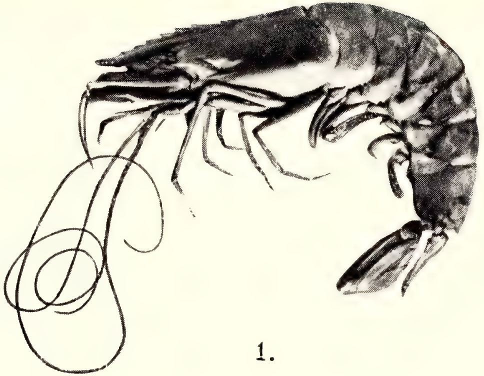

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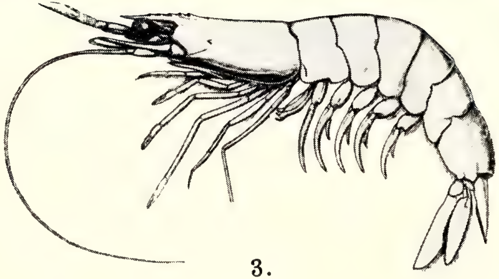

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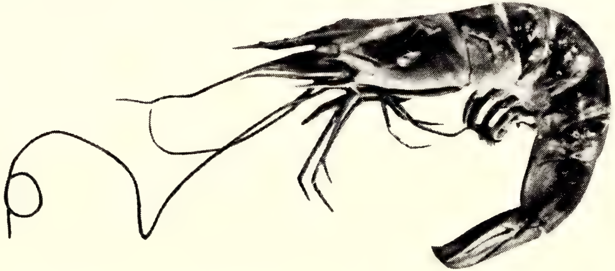

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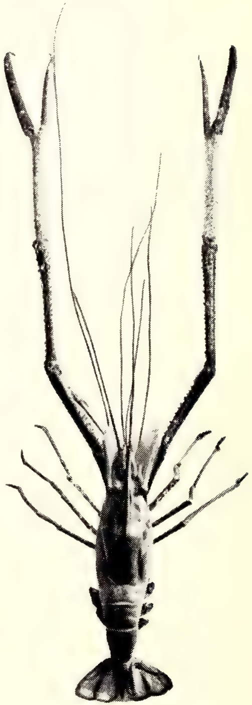

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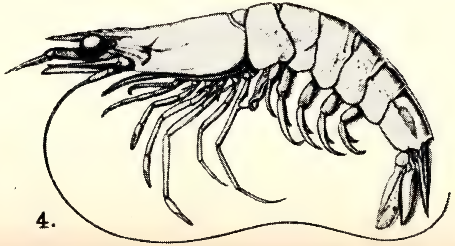

4.

Food Prawns and Crabs of India.

(For identification see end of article.)

SOME FOOD PRAWNS AND CRABS OF INDIA AND THEIR FISHERIES.[1]

BY

B. CHOPRA, D.SC., F.N.I.,

Assistant Superintendent, Zoological Survey of India, Calcutta.

(*With 5 plates*)

According to some natural-history writers Francis Drake, the famous navigator, was killed and eaten by crabs. One version describes his death as follows: 'This navigator having landed on the Isle of Crabs in America he was immediately surrounded by these animals; although he was armed, although he made a stout resistance, he had to succumb. These monstrous crustaceans, the largest known in the world, cut in pieces with their claws his legs, his arms, and his head, and gnawed his carcass to the very bones.' This blood-curdling story is partly based on truth. It is true that Drake once landed on Crab Island; it is equally true that he met with huge crabs there; it is not, however, true that the crabs ate Drake, but it was Drake and his men that ate the crabs, of which a single one, they stated afterwards, was sufficient to make a meal for four men. An equally fantastic 'unnatural-history' story is that by Olaus Magnus of a giant lobster. He states that between the Orkneys and the Hebrides on the north-west of Scotland there lives a kind of lobster so large and so strong that it can catch a swimmer in its claws and squeeze him to death. His picture, as reproduced by Stebbing (1893), shows a bearded man as a mere plaything in the arms of this giant crustacean.

Let us, however, turn to the more pleasant subject of the crabs, prawns and lobsters that we eat, rather than to those that may or may not eat us. Ever since man acquired a taste for animal food and the skill to capture aquatic animals, prawns and crabs have been eaten by him, and to this day a boiled lobster or curried prawn is relished by most of us. Not only is prawn and crab meat tasty and nourishing, but in several countries of the world, including India, it is believed to have valuable medicinal properties; I will refer to this aspect of the question later. Practically all species of prawns and crabs are edible and a very large number of these are eaten all over the world, the only necessary condition being that the species should be sufficiently large or abundant to make it worth while fishing for it. I will first briefly discuss some of the Indian species that are readily available in the markets of our large towns, and are consumed on a large scale.

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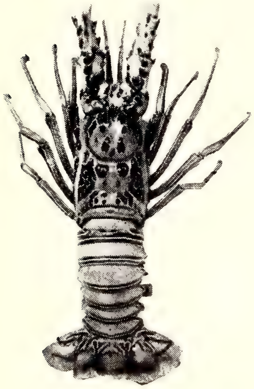
[1] Published with the permission of the Director, Zoological Survey of India. The article is a slightly modified version of a popular lecture, illustrated with lantern slides, delivered in the Indian Museum, Calcutta.

All prawns, shrimps and lobsters are aquatic and most of our commercial species live in the sea and in the estuaries of our great rivers. The commonest of these are the Penaeids, in which the first three walking legs end in claws and not in simple hooks. Take for instance *Penaeus carinatus* (Plate I, fig. 1), which is called *Penaeus semisulcatus* by some authors. This prawn is known in Calcutta as *Bagda chingri,* and is eaten in large quantities in one form or another, but most commonly served up as cutlets. This is the commonest large-sized Penaeid of Calcutta, and is sold in our markets in enormous quantities. It grows to a length of almost a foot, and is very abundant all over the deltaic region, and in a large number of other places along the Indian coast. Another slightly smaller species, but also fairly common in the markets all over India, is *Penaeus indicus* (Plate I, fig. 2). This is the *Chapda chingri* of Calcutta, the name no doubt being due to the somewhat laterally compressed form of the animal. This prawn attains a length of about 8 inches, but in Bengal it is not quite so abundant as the *Bagda.* Two other Penaeids occurring very plentifully in the delta of the Ganges are *Metapenaeus brevicornis* (Plate I, fig. 3) and *Metapenaeus monoceros* (Plate I, fig. 4). The former is known in Calcutta as *Dhanbone chingri,* from the fact that as a result of inundations it is found in vast numbers in the paddy fields during and after rains. This is probably the commonest Penaeid of Bengal. It grows to a size of about 4 inches. The second species, *M. monoceros* is the *Koraney chingri* or *Honye chingri* of Calcutta markets, and grows to about 5 inches or a little over in length. This Penaeid, a hardy creature—a fact to which it probably owes its first local name—generally arrives in the market living. When dead, the colour is very much like that of *M. brevicornis,* with which it is often mixed for sale. Its second name, *Honye chingri* or mad prawn, is probably due to the fact that even long after capture it jumps about like a mad creature. These two prawns are bought in large quantities, chiefly for making curries. The four prawns just mentioned, along with several other species, occur all round the Indian coast, but whereas one species may be very common in Bengal, another species may take its place, say on the Sind coast.

Another very large-sized prawn of the Calcutta market is the *Golda chingri* or *Mocha chingri.* This is not a Penaeid, but a fresh-water animal, although it has accustomed itself to living in slightly brackish waters also. It is scientifically known as *Palaemon carcinus* (Plate I, fig. 5), and occurs extensively in rivers, canals, *bheels* and tanks. The local name *Golda* is probably due to its somewhat rounded or tubular form, in contrast with the Penaeids, which are laterally compressed, while in *Mocha* some sort of resemblance to the blossom of a plantain tree is perhaps suggested. This prawn grows to a foot or more in length and a single specimen may



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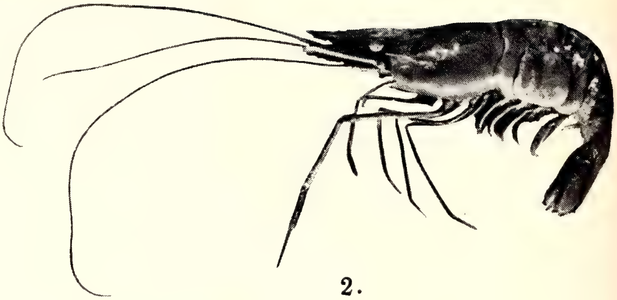

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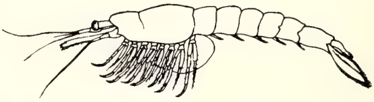

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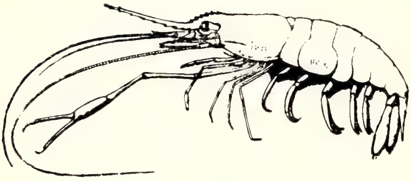

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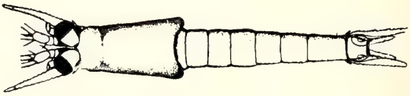

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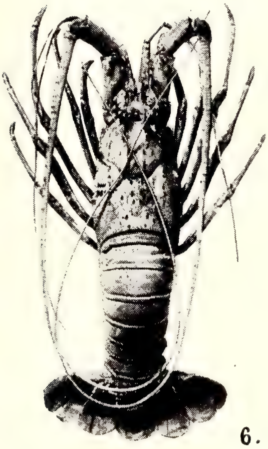

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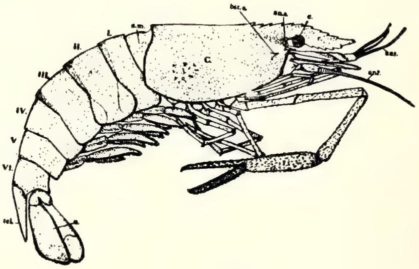
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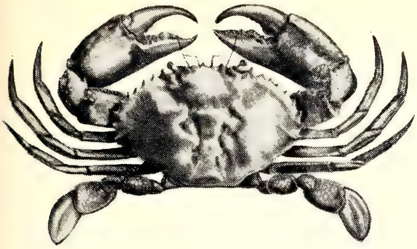
FOOD PRAWNS AND CRABS OF INDIA.
(*For explanation see end of article.*)

weigh more than a pound. In this animal the third leg does not end in a claw; this is a characteristic of the true fresh-water prawns as opposed to the Penaeids in which this leg is also chelate. *Palaemon carcinus* occurs and is extensively fished in several other parts of India also. There are many other fresh-water, or partly brackish-water prawns are also eaten in different parts of India. Of these *Kuncho chingri* (*Palaemon lamarrei*, Plate I, fig. 6), *Ghora chingri* (*Leander styliferus*, Plate II, fig. 1) and *Ghusha chingri* (*Caridina gracilipes*) must be familiar to many people in Calcutta. All these three are comparatively small in size; the first two seldom exceed a couple of inches in length, while the third, *Ghusha*, as the name indicates, is still smaller, being less than an inch or so. There is, however, a larger form, *Palaemon rudis* (Plate II, fig. 2) which is quite common in some parts of Bengal from August to October, when large numbers of females, carrying eggs, are brought down to the market. This prawn is known in some parts of Bengal as *Goda chingri*. The name probably refers to the stout, almost swollen build of the animal, something like the *Goda-pa* or swollen foot of a Filaria patient. Another large-sized prawn, extremely common in the Chilka Lake, Orissa, Central India and parts of the Peninsula is *Palaemon malcolmsonii* (Plate II, fig. 3). This is almost six inches in length and is very extensively fished in the Chilka Lake.

Now we come to what is known in Calcutta as *Kada chingri* or 'mud-shrimps'. Those who have visited Chingrihatta or some of the other outlying markets of Calcutta, may have noticed large heaps of what looks like grey mud lying on the ground. Small lumps of this mud are sold by the stall-keepers. These consist of tiny, shrimp-like creatures, known as Mysids, each animal barely a quarter of an inch long. *Macropsis orientalis* (Plate II, fig. 4) is the predominant form in these heaps, but *Potamomysis assimilis* (Plate II, fig. 5) also occurs in large numbers. The Mysids are not true prawns or shrimps, but on account of their possessing a brood-pouch in which the young are carried, they are sometimes popularly known as 'Opossum shrimps'. These creatures are so small that thousands of them must be eaten to make a square meal. *Kada chingri* is of course sold very cheap, a lump or a handful of it being worth a pice or so. It is mostly sought after by the poorer classes.

From the humble *Mysis* to the mighty lobster is a big jump, but even the poor may have rich relations. Both have their uses for us; the former fills the pot of the poor, while the latter adorns the table of the rich. I have already mentioned the man-eating lobsters of the north-west of Scotland, which according to Olaus must indeed have been of titanic size and herculean strength. In India fortunately we have no lobsters large and strong enough to squeeze a man to death; in a way it is a pity for such lobsters might have helped us to solve the food problem of the country. Our common lobster, or really Spiny Lobster or Sea-Crawfish, *Panulirus polyphagus* (Plate II, fig. 6), or *Panulirus fasciatus*, as it has been called by some people, is but a pigmy in comparison with the Scottish giant of Olaus's imagination. It is about 15 inches long and does not weigh more than a couple of pounds. It occurs quite commonly in suitable places along the eastern coast of India and prefers a rocky or stony bottom, a little beyond the low-tide limit. The common species of the Bombay coast is *Panulirus ornatus* (Plate II, fig. 7). It hardly grows to a foot in length and is found in fairly large numbers on rocky beds, generally in waters somewhat shallower than those in which *P. polyphagus* lives. Lobsters fetch a high price in some markets, but in Calcutta, for instance, I am told that on account of their spiny shells they do not find favour with certain sections of the population. In Europe and America lobsters sometimes grow to an enormous size; there are authentic records in America of lobsters weighing as much as 23 pounds.

Now let us consider our food-crabs. Crabs are also essentially aquatic animals; some have no doubt taken to land, but on account of the necessity of keeping their gill-filaments moist, most of them have to live comparatively near water. The family Portunidae containing the swimming crabs, contributes the largest proportion of our food-crabs. In these crabs the last leg is in the form of a paddle. *Scylla serrata* (Plate III, fig. 1) is the commonest food-crab of India and is fished extensively all along the coast. It is generally 5-6 inches across the carapace or the back shield, though Dr. Ramaswami Nayudu of the Madras Fisheries Department has informed me that in the Chilka Lake he has seen huge Scyllas, which he estimates to have been 15-18 inches broad. This crab, known in Bengal as *Nona kankra*, or the salt-water crab, occurs very abundantly in the Delta. This is really a brackish-water species, but also adapted to living in practically fresh waters. Besides swimming about in the water it also lives on the edge in deep burrows going below the water-level. Two or three other swimming crabs are also eaten in considerable quantities in areas near the coast. *Neptunus pelagicus* (Plate III, fig. 2) and *N. sanguinolentus* (Plate III, fig. 3) are two such forms. These live mostly in the sea or in brackish waters. *N. pelagicus* is extensively fished in the Chilka Lake, where it has accustomed itself to living in practically fresh water for at least a part of the year. These two species grow to at least 5 or 6 inches in size. Certain species of *Charybdis*, another swimming crab, are also brought to the markets of towns on the sea coast. Some of these swimming crabs are very vividly coloured; *C. cruciata*, for instance, has its colour markings arranged in the form of a cross. Another crab of some local importance, in Bengal at least, is *Varuna litterata* (Plate III, fig. 4) or *Chitti kankra*. It is not a swimming crab, as is seen from the shape of its last legs. It is a small species, seldom exceeding a couple of inches in the width of its carapace, but the smallness of its size is more than made up by the enormous numbers in which it is found in creeks of the Gangetic Delta (Plate III, fig. 5) at certain times of the year. Those who have bathed in the Hooghly at Calcutta towards the middle of the rainy season must have noticed myriads of little crab-like creatures, come crawling up the legs and bodies of the bathers; these are the young ones of *Varuna*. This crab is not really of any great commercial importance, but is extensively fished,



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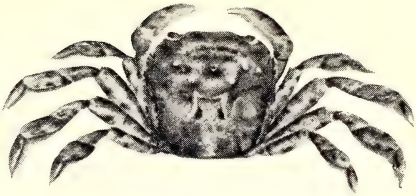

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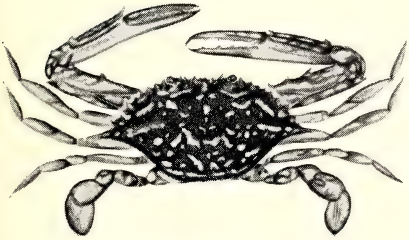

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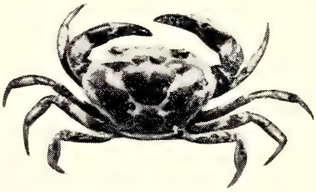

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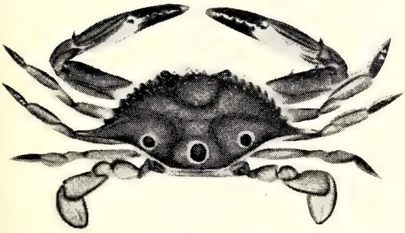

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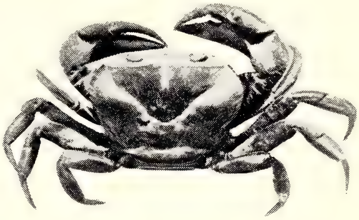

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Food Prawns and Crabs of India.

(*For explanation see end of article.*)

chiefly for domestic consumption and for local sales to the poorer sections of the people. At Uttarbhag in the Gangetic Delta, for instance, it occurs in ponds etc. in such large numbers that quantities of it can be scooped up with the hand or with a small net. Verily this is a case of reaping a rich harvest without even sowing it.

Then there are some fresh-water crabs that are largely eaten not only in the Provinces bordering the sea, but also inland. The common fresh-water crab of Bengal is *Paratelphusa spinigera* (Plate III, fig. 6). It occurs abundantly near tanks, *bheels* and rivers. It is known in Bengal as *Pati kankra* and grows to about 3 inches across the carapace. Two other species of this genus are common in the Madras and the Bombay Presidencies. The Bombay species, *P. jacquemontii* (Plate III, fig. 7), is much bigger than the Bengal form, growing sometimes to as much as 5 inches in carapace breadth. It is sent for sale to the Bombay markets in large numbers.

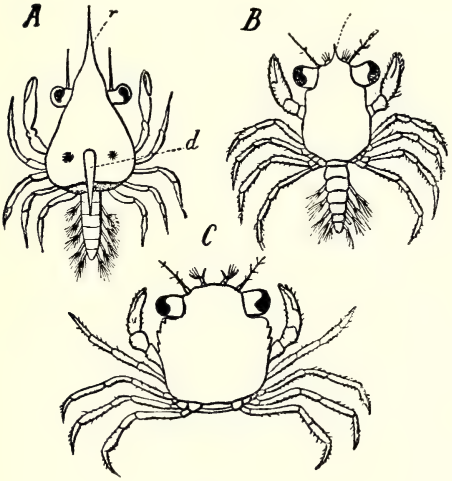
I have described so far prawns and crabs that we eat as such, but enormous quantities of these and of smaller crustaceans are consumed by us indirectly. Crustaceans form the food of a large number of fishes that we eat; the pink or red colour of the salmon, for instance, is believed to be due entirely to the shrimps on which it feeds, while it is in the sea. In the same way the Bombay Duck—one of our important food fishes and not a duck as the name suggests—also feeds largely on shrimps. In fact the migration of this fish can generally be traced by the movement of shoals of shrimps.

Crabs and prawns are as a rule of a very timid and retiring disposition, hiding themselves in holes and crevices of the surface on which they live. At the slightest approach of danger they scuttle away to their burrows or lie quiescent on the substratum, where in the midst of weeds, etc. they generally escape notice. At certain places on the Chittagong coast an Ocypod crab of a bright red colour is extremely abundant. It lives near the water-edge in such large numbers that from a little distance the place looks as though covered with red flowers. Try to approach these flowers and they disappear, as if by magic. The crab is a swift runner and at the approach of any danger bolts into its burrow. If you succeed in cutting off the retreat and, if ultimately cornered—it will give you a good race—it raises itself on its hind legs, waving its large white claws, as if challenging you to a fight. This is true of *Scylla serrata* also. It sits outside its burrow on the muddy banks of the estuaries, wearing the dingy, earthy colour of its residence, waiting to snap up any food that may come its way. At any one's approach it vanishes swiftly into its hole, but, if cornered, it shows fight, for it knows that in its huge claws it possesses a very serviceable weapon, and I can tell you from my own experience also that a bite from these claws can be very painful indeed. Once a crab gets a firm hold of any object, say your finger, it seldom lets it go, and it is easier to break off the claw than try to loosen its grip. Some small scale fisheries of *Scylla* and of some fresh-water crabs are based on this habit of theirs; introduce a stick or some similar object in their burrow and induce the crab to grip it, you can then gently pull out the stick and will often find the crab dangling at the end.

Crabs, prawns and lobsters eat practically any food, living or dead, that comes their way. As scavengers of the sea and the shore they play an important role in Nature. Large crabs eat small crabs, which in their turn feed on still smaller ones. A dead crab let down in a lobster trap will attract one species or another, the clan trooping to the feast in large numbers, till every particle of the dainty repast has been consumed. The voracity of some of the smaller crustaceans is such, and their numbers in some places so enormous that they have been known to clear all the flesh of a dead seal in a single night. Certain species are said to prefer living food, though in times of scarcity they will eat anything. The spiny-lobster of South Africa is believed to feed largely on mussels and such other creatures, the shells of which it breaks with its powerful 'nut-cracker' jaws. Some crabs have also been known to do great damage in oyster beds by eating the young oysters, while their shells are still soft and easy to break. The harm done by crabs to fish after capture, is also well known.

The great majority of crustaceans, including most prawns and crabs, are hatched from the egg in a form differing greatly from that which they finally assume, and reach the adult state only after passing through a series of very remarkable transformations. Take the case of the shore-crab *Carcinus maenas*. The youngest larva is a translucent little creature less than one-twentieth of an inch long, and as different from the adult crab as a caterpillar is from the butterfly. A few hours after hatching it moults or casts its skin for the first time and assumes the form known as the *Zoea* (Plate IV, fig. 1). It swims about on the surface, feeding on minute animals and plants and growing in size with the repeated castings of its skin. The details of the life-history are somewhat complicated, but a little later, by a rapid transformation, or metamorphosis, it emerges as a *megalopa* (Plate IV, fig. 2). The animal has now all the appearance of a little crab, except that the abdomen is still stretched out instead of being tucked up under the body, and the appendages of the abdomen are still used as swimmerets. It later sinks to the bottom and, moulting again, appears as a little crab. It is still barely an eighth of an inch long, but voracious feeding and repeated moultings bring it to adult size, which may be as much as 4 inches across the back.

The life-cycle of our Penaeid prawns (Plate IV, fig. 3) is still more remarkable. The youngest form is so minute that it can barely be seen with the naked eye. This is the *nauplius*—a pear-shaped, unsegmented creature, with a single median eye, in fact totally unlike the adult prawn. The *Zoea* stage somewhat like that of the crab just mentioned, comes later and is followed by the *Mysis* stage, in which the prawn-like shape is assumed. Changes from one stage to the other and increase in size are effected by rapid transformations and moultings. Though some Penaeids have taken to living in brackish or even fresh waters, they migrate to the sea for breeding.



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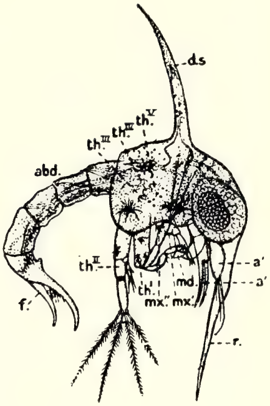
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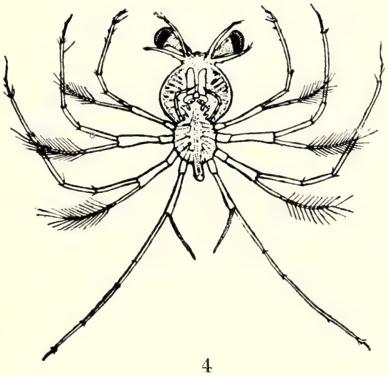

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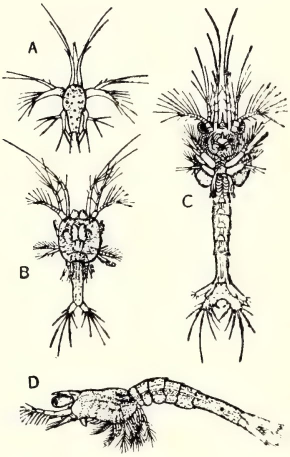

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Food Prawns and Crabs of India.
(*For explanation see end of article.*)

A very early larva of our spiny lobster, the *phyllosoma* larva as it is called, is a broad, thin and leaf-like creature (Plate IV, fig. 4). It is so transparent that some of the larger ones were formerly known as 'Glass crabs'. Here again a number of metamorphoses take place before the adult form is assumed.

I have referred to moulting in connection with increase in size. All prawns and crabs, as we know, have a hard shell on the outside, which not only affords protection to the animal and gives support to the internal organs, but also supplies points of attachment for the muscles with which the animal moves. It thus plays the part of a skeleton, but unlike ours, which is inside the soft parts of the body, the exoskeleton of the crustacean is outside the body. This external covering does not increase in size after it has been formed, nor is it flexible to any extent. The animal, therefore, has to cast its shell periodically as it grows in size. The shell splits in certain places, the body and limbs are gradually worked loose and are withdrawn through the opening, leaving behind the empty shell, with all its appendages almost entire. A new covering, which is only a thin, flexible membrane has already been formed beneath the old shell before moulting. The animal now rapidly grows in size by the absorption of water and the soft shell gradually hardens by the deposition of lime salts. It, so to say, rests now to consolidate its gains till it is ready for another increase in size, when the whole process is gone through again.

There is only one more point that I will refer to in this connection and that is the power some of these animals have of voluntarily throwing off their limbs and regenerating them later. If you catch hold of a crab by one of its legs, and especially the hinder legs, it will often free itself by breaking off the leg, leaving it in your hand and itself scuttling away to safety. To save its life it sacrifices a limb, but the sacrifice is only a temporary one, for the limb is later regenerated and becomes as efficient an organ as its predecessor.

Most of us who eat prawns and crabs must be aware that there are fisheries of these animals for supplying our needs, but many of us do not know the extent of these fisheries. In some of our markets, both in quantity and value, crustaceans are of greater importance than any kind of fish, the prawns topping the list and the crabs usually coming next. On the Bombay coast, for instance, millions of pounds of prawns are caught annually. Apart from local consumption, large quantities are despatched inland and also exported to foreign countries. The total annual consumption along this coast has been estimated at 12 million pounds, valued roughly at 25 lakhs of rupees. The prawn industry along the Bombay coast gives employment to about 20 thousand men, women and children. There is also a flourishing trade in dried prawns and in their shells—the latter are used as manure—Karachi alone having exported these commodities to the value of 11½ lakhs of rupees a few years ago. Similarly there are very extensive prawn fisheries on the Chilka Lake, in the Colair Lake in Madras, in the backwaters along the Malabar coast, in several creeks of the Gangetic delta and in many other parts of the country. A great deal of the catch is consumed fresh in the country, but enormous quantities are also dried and exported to Burma, the Straits Settlements and other countries. Dr. Ramaswami Nayudu of the Madras Fisheries Department, who carried out a survey of the Bengal Fisheries recently, has informed me that, at a very conservative estimate, 3,00,000 maunds of dried prawns valued at nothing less than 70-80 lakhs of rupees are exported from Bengal every year, mostly to Burma. At a very rough and conservative estimate the total yield of the prawn fisheries of India must be at least three crores of rupees every year.

This figure, impressive though it may seem, however, pales into insignificance when compared with the value of similar fisheries in some other much smaller countries of the world. I will give only two instances. Take the Prawn industry of Norway. In 1897, Dr. Hjort, a great naturalist employed on the fisheries staff, discovered that the softest mud at the bottom of the fjords of south-western Norway was inhabited by an unexpected wealth of the prawn *Pandalus borealis*. After many unsuccessful attempts he succeeded in devising a trawl that could be dragged along the bottom without filling with mud. Before these experiments were made *P. borealis* was hardly known, except to the scientist, but since then a new fishery has arisen, the growth of which has been very remarkable. In recent years the catches have amounted to as much as 4 thousand tons annually. In 1930 the yield of the industry was estimated, in Indian currency, at considerably over 3 crores of rupees, and more than 60 thousand people were employed. The prawn is about four or five inches in size and lives in comparatively deep waters, sometimes being found up to the 100-fathom line. Similarly, in the northern parts of Japan and along the Siberian coast there lives a hermit-crab, *Paralithodes camtschatica*, that grows to a very large size, some examples having a span of four feet or so. On account of its size, it cannot find a shell large enough to live in, as most hermit-crabs do, and takes shelter in crannies of rocks, etc. This crab is extensively fished in Japan and is canned for export purposes, chiefly to the United States of America. In the earlier stages considerable difficulties were encountered, mostly in satisfactory canning, but patient researches by enthusiastic scientists have overcome these and thus, during recent years, the industry has yielded several crores of rupees annually.

It is regrettable to find that nowhere in India are the crab and prawn-fishing industries run on sound scientific lines or even on modern commercial methods. All that is done at present, as it was no doubt done generations ago, is that fishermen in small family groups do the fishing, either for themselves, or in most cases for middlemen (to whom they are heavily in debt), with small country boats and antiquated appliances. Most of the fishing is done only in comparatively shallow waters while the practically unlimited wealth of the deep still lies altogether unexplored. The catch is sold fresh, mostly through rings of middlemen, for the markets of neighbouring towns or for despatch inland. When the yield is more than can be consumed fresh, prawns are dried or even boiled and dried for export purposes. The methods employed are crude. Drying is done mostly in the sun, the shells are separated by trampling or by threshing and packed in ordinary gunny bags. Very little canning is done anywhere at present, though experiments in this direction have been made in the past; the success of these experiments, even though partial, indicates that, if properly handled on scientific lines, a flourishing industry of canned prawn and crab meat could probably be established in the country.

The actual methods employed for the fishing of prawns are very similar all over the country. The commonest net used is a kind of fixed Purse net, conical in shape, the length, mesh and diameter at the mouth varying with the local conditions and according to the depth at which it is used. In Bengal this net is known as *Behundi Jal* and may vary between 30 feet and 120 feet in length. On the Bombay coast the *Bokshi*, for use in shallow waters, is about 30 feet long, while the *Dol*, which is employed in deeper waters may be as much as 700 feet in length, with the mouth about 300 feet in diameter. The narrow end of the cone has generally a detachable bag tied on to it. The broad end of the net is attached to poles fixed in the ground in suitable places and the nets are set against the tide, which sweeps the catch into them. The picture given by Rai[1] (1934) shows a number of *Bokshi* nets on the Bombay coast set in position. Similarly the *Moi Jal* of Bengal, which is a drag net, has its counterparts in other provinces of India.

In the backwaters of Cochin and Travancore prawn-fishing[2] is carried out on a very extensive scale. During the rains these waters are practically fresh, but after the north-east monsoon the backwaters and the connecting canals become increasingly brackish. In certain places there are paddy fields adjoining the backwaters and the canals. Paddy is cultivated in them only during July to October; during certain other months of the year these fields yield a very rich harvest of Penaeid prawns. With the lowering of the water-level in the backwaters, after the end of the monsoon, the *bunds* surrounding the fields are strengthened and water is allowed to enter or flow from the fields through sluice gates only, its level being regulated by a series of adjustable planks. At high tide the sluice gates are opened to permit a free inflow of water into the fields, bringing in large numbers of young prawns that abound in the backwaters at this time. With the onset of the ebb-tide the sluices are closed. This goes on regularly for a month or so. Actual fishing takes place only two or three months after the prawns have entered the fields; during this period they have grown in size and are now about four or five inches long. A large conical net, like the *Bokshi* used on the Bombay coast, is fitted to the outside of the sluice gate, the wide mouth of the net completely surrounding the gate. When, with the onset of the ebb-tide, the water-level outside the fields begins to fall, the planks retaining the water in the fields are removed one by one, thus forcing it through the gate and through the net fitted outside. The prawns are all caught in the net and are removed from the narrow end by a man who generally sits in a boat by the side of the net. Fishing is usually done at night, the actual time changing with the tides.

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[1] Rai (1934) has described prawn- and crab-fishing along the Bombay and Sind coasts.

[2] See Panikkar (1937) for details of prawn-fishing in the backwaters of Cochin and Travancore.

Besides this, fishing in the open backwaters is also done on a large scale. Two country boats are tied together as shown by Panikkar (1937), the intervening space supporting a large net. Prawns, as we know, swim in shoals; the boats are stationed where shoals have been located, and any prawns swimming through are caught in the net. Another contrivance used in these parts is locally known as the 'Chinese net'. A large number of wooden frameworks are set up in suitable places on the edge of the backwater, each suporting a Chinese net, which is raised and lowered, as the occasion demands. A strong light to attract prawns is generally hung to the framework when the net is lowered.

A very ingenious method of trapping prawns is employed on the Chilka Lake.[1] The Uriya fisherman is a keen observer of the habits of the animals that form his means of sustenance. He knows that prawns are mainly nocturnal in habit and are accustomed to walk at night in the very shallow water along the edge of the lake. If they come to any obstacle, such as a fence, they do their best to make their way round it. He is also aware that they have a way of forcing themselves into any little cranny that they come across, in order to remain concealed and protected during the day. Taking advantage of these habits of the prawn, he has devised a clever way of trapping it (Plate V, fig. 2). From the shore he builds into the lake a bamboo fence which may be as much as 50 feet long, and round its farther or lake end, in about three feet of water he makes an enclosure of traps arranged in a circle or oval. Each trap (Plate V, fig. 1) is a rectangular basket about 4 feet high made of narrow strips of bamboo fastened together with creeper stems. On one face there are three or four apertures protected within by converging strips of bamboo, that render it very difficult for a prawn that has once entered the trap to escape. These traps are set with the apertures facing inwards. Very early in the morning, or perhaps even before dawn, some of the prawns walking about on the shore encounter one of these fences, and are, so to say, easily led into the enclosures, where, with the approach of day-light, they take refuge in the traps.

An equally ingenious method (Plate V, fig. 3) is used for fishing crabs in the creeks of the Gangetic delta.[2] I have already referred to the tenacious habit of our common food-crab *Scylla serrata*. At

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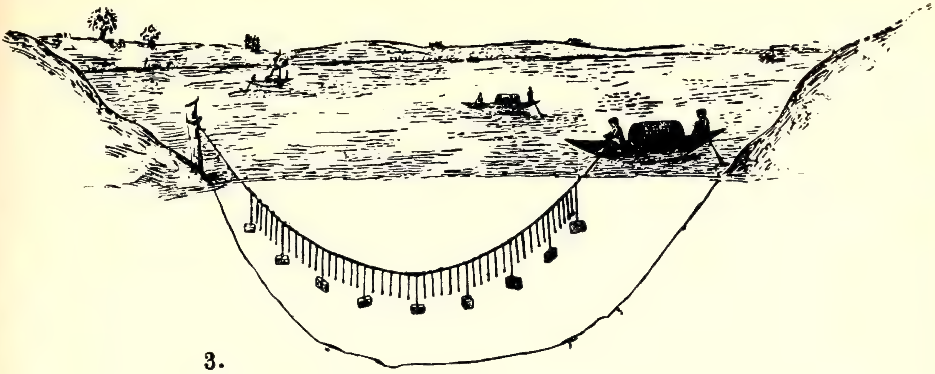
[1] Kemp (1915) and Annandale (1915) have described prawn-fishing in the Chilka Lake.

[2] See Hora (1935) for crab-fishing at Uttarbhag.



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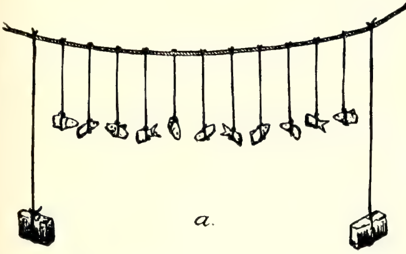

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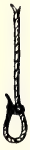

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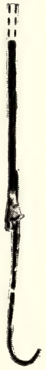

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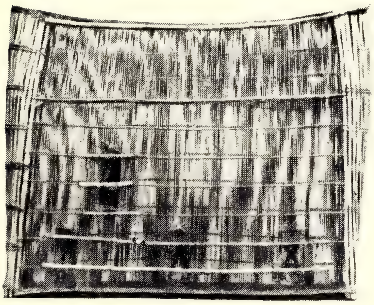

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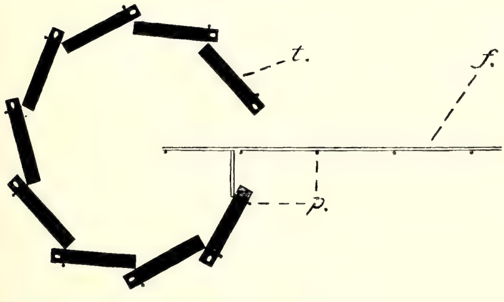

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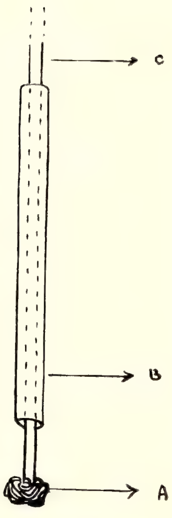

4.

FOOD PRAWNS AND CRABS OF INDIA.
(*For explanation see end of article.*)

Uttarbhag, on the banks of the Piali, this crab is fished on a large scale. A line is stretched across a suitable creek, one end fastened to a pole dug into the bank, and the other fixed to a post in a boat, which is rowed to the opposite bank. The line is weighted with pieces of brick tied to it at regular intervals, and in between, these pieces of dead fish are suspended as bait. Crabs are attracted to the bait and cling to the line with their powerful claws. When the men in the boat feel that the line has become sufficiently heavy with the weight of the crabs, they pull it in, with the crabs hanging on to the bait. Sometimes the number of crabs is so large that five or six men are required to pull in the line. Devices somewhat like this are employed for fishing crabs in several other parts of the world also.

I will mention only one other, very simple, but efficient, device for capturing fresh-water crabs in the Ceded districts of South India.[1] A Potamonid crab, *Paratelphusa hydrodromus*, is quite common there and is largely eaten. It lives in deep burrows on the muddy banks of ponds and small canals. A large stick (Plate V, fig. 4) with a swollen node at one end is taken and fitted into a hollow bamboo, so that the bamboo-casing can be freely moved up and down this stick. The node at the lower end of the stick may be reinforced by winding a rope around it, the idea being that the barrel should not slip off the stick. This implement is passed down the crab-burrow, and when the crab catches hold of the lower end of the stick with its powerful chelae, the bamboo-barrel is pushed down and pressed hard against the animal, which can now be hauled out. A somewhat similar, but perhaps less efficient, implement (Plate V, fig. 5) is used at Uttarbhag[2] also for catching *Scylla* on a small scale. The blunt iron hook at the lower end of the bamboo stick is used in this case for hooking the crab in its burrow, which is often badly mutilated before it can be pulled out.

In the earlier part of the article I referred to the supposed medicinal value of crab meat. In India at least this belief is quite wide-spread. On the Bombay side and in the Deccan crab curry is a reputed cure for asthma. Similary soup made from *Scylla* and *Neptunus* is commonly used by people just after recovery from malaria, when it is supposed to act as a specific tonic. *Paratelphusa* soup is believed to cure colds. According to some Ayurvedic authorities crab curries are recommended in cases of chronic fevers. Professor A. Ramakrishna Reddy of Annamalai University has collected a great deal of information about the medicinal uses of crab meat in the South, and has got together some recipes for the cure of asthma, chronic fevers and other ailments, but whether these are efficacious or not, and whether the cure, if any, is due to some properties of the meat or of the other ingredients used in the recipes I am unable to say.

Before closing I would like to make a strong plea for the scientific development of the prawn and crab fisheries of India.

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[1] See Reddy (1936).

[2] See Hora (1935).

With our vast coast line, enormous estuaries, lagoons and back-waters, and a net-work of great rivers inland, where the physical and biological conditions for the growth and propagation of these animals are for the most part extremely favourable, we have a source of untold wealth, which at present is but very partially exploited. The first essential requirement for putting the industry on a sound footing, however, is to study scientifically the animals concerned. We should thoroughly investigate their bionomics, chart the grounds on which they flourish best, study their breeding seasons, life-histories, migration and numerous allied problems. Some sort of protective measures, based on this scientific study, should follow in due course and be strictly enforced. That even the most elementary principles for safeguarding the industry are ignored at present can be judged from the fact that intensive fishing is carried on even during the season when the females are breeding and it is a very common occurrence to see females 'in berry' being openly sold in large quantities. In most countries in which the fisheries are run on scientific lines, not only is the sale of such females prohibited by law, but even their purchase and possession are illegal. Improvements, wherever required or possible, in the fishing gear used at present, and devising new gear for trawling in our deeper waters should also be undertaken. Side by side with these scientific investigations, the commercial side will also have to be developed, and when the question of canning comes up—as it is bound to come up in course of time—the aid of the scientist will have to be requisitioned once again. Like all big industries, fisheries can also be best tackled by team work; to make them a success we want the labour of the fisherman, the capital and business acumen of the rich industrialist and the patient researches of the humble scientist.

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EXPLANATION OF PLATES.

Plate I.

1. *Penaeus carinatus* Dana ; greatly reduced. Photo.
2. *Penaeus indicus* Milne-Edwards ; greatly reduced. Photo.
3. *Metapenaeus brevicornis* (Milne-Edwards) ; greatly reduced. (From Alcock, *Cat. Ind. Dec. Crust.*, Part III, pl. iv, fig. 10, 1906.)
4. *Metapenaeus monoceros* (Fabricius) ; greatly reduced. (From Alcock, *Cat. Ind. Dec. Crust.*, Part III, pl. iii, fig. 7, 1906).
5. *Palaemon carcinus* (Fabricius) ; photograph of a specimen exhibited in the Invertebrate Gallery of the Indian Museum, greatly reduced.
6. *Palaemon lamarrei* Milne-Edwards ; *ca.* natural size. Photo.

Plate II.

1. *Leander styliferus* Milne-Edwards ; *ca.* natural size. (From Kemp, *Rec. Ind. Mus.*, xiii, pl. viii, fig. 2, 1917).
2. *Palaemon rudis* Heller ; greatly reduced. Photo.
3. *Palaemon malcolmsonii* Milne-Edwards ; greatly reduced. *a.m.*, arthrodial membrane between the thorax and the first segment of the abdomen ; *an* 1., antennule ; *an* 2., antenna ; *an. s.*, antennal spine ; *bst. s.*, hepatic spine ; *c.*, cephalothorax ; *e.*, eye ; *r.*, rostrum ; *tel.*, telson ; *u.*, uropod ; I, II, III, IV, V and VI, abdominal segments. (From Patwardhan, *Palaemon* ; in *Indian Zoological Memoirs*, vi, 1937.)
4. *Macropsis orientalis* Tattersall ; considerably enlarged.
5. *Potamomysis assimilis* Tattersall ; considerably enlarged. (From Tattersall, *Rec. Ind. Mus.*, ii, pl. xxi, fig. 1, 1908.)
6. *Panulirus polyphagus* (Herbst) ; greatly reduced. (From Gruvel, *Ann. Inst. Océanogr.*, iii, pl. v, fig. 3, 1912.)
7. *Panulirus ornatus* (Fabricius) ; greatly reduced. (From Gruvel, *Ann. Inst. Océanogr.*, iii, pl. vi, fig. 2, 1912.)

Plate III.

1. *Scylla serrata* (Forskål) ; greatly reduced. (From Rüppell, 24 *Krabben roth. Meer.*, pl. ii, 1830.)
2. *Neptunus pelagicus* (Linnaeus) ; greatly reduced. (From Sakai, *Crabs of Japan*, pl. xxxviii, 1935.)
3. *Neptunus sanguinolentus* (Herbst) ; greatly reduced. (From Sakai, *Crabs of Japan*, pl, xxxix, fig. 1, 1935.)
4. *Varuna litterata* (Fabricius) ; considerably reduced. (From Sakai, *Crabs of Japan*, pl. lxiii, fig. 2, 1935.)
5. Photograph of masses of *Varuna litterata* as seen on the sloping banks of some creeks in the Gangetic Delta just before the rains.
6. *Paratelphusa* (*Paratelphusa*) *spinigera* (Wood-Mason) ; greatly reduced. (From Alcock, *Cat. Ind. Dec. Crust.*, Part I, pl. xi, fig. 53, 1910.)
7. *Paratelphusa* (*Barytelphusa*) *jacquemontii* (Rathbun) ; greatly reduced. (From Alcock, *Cat. Ind. Dec. Crust.*, Part I, pl. xii, fig. 55, 1910.)

Plate IV.

1. Zoea of *Carcinus maenas* ; greatly enlarged. a', antennule ; a'', antenna ; *abd*, abdomen ; *d. s*, dorsal spine of carapace ; *f*, telson ; *md*, mandible ; mx', first maxilla ; mx'', second maxilla ; *r*, rostrum ; th^{i}, th^{ii}, first and second maxillipeds ; th^{iii}—th^{v}, rudiments of next three thoracic appendages. (From Calman, *Crustacea* : in Lankester's *Treatise on Zoology*, p. 304, fig. 181, 1909.)

2. Later stages in the development of *Carcinus maenas*; greatly enlarged. A, young Megalopa; B, older Megalopa; C, post-larval stage; *d*, dorsal spine of carapace; *r*, rostrum. (From Calman, *Crustacea*: in Lankester's *Treatise on Zoology*, p. 305, fig. 182, 1909.)
3. Larval stages of the Prawn, *Penaeus*; greatly enlarged. A, Nauplius; B, young Zoea; C, older Zoea; D, early 'schizopod' or 'mysis' stage. (From Calman, *Life of Crustacea*, p. 74, fig. 29, 1911.)
4. Phyllosoma Larva of a Spiny Lobster, *Panulirus*; greatly enlarged. (From Calman, *Life of Crustacea*, p. 72, fig. 28, 1911.)

Plate V.

1. Photograph of a trap used for catching prawns on the Chilka Lake; greatly reduced.
2. Diagrammatic representation of the fence and enclosure of traps used for catching prawns on the Chilka Lake. *f*, bamboo fence leading from the shore into the Lake; *p*, poles dug into the ground for holding the fence and the traps in position; *t*, traps (as shown in figure 1 on this plate) arranged in a circular enclosure.
3. Diagrammatic representation of the method employed for fishing *Scylla serrata* in some creeks of the Gangetic Delta.

   The upper figure represents a section of the creek and shows the line in position; the lower figure shows (*a*) a portion of the line, with the arrangement of weights and bait with (*b*) slip-knots. (From Hora, *Current Science*, iii, p. 544, figs. 3 and 4, 1935.)
4. Diagrammatic sketch of the implement used for catching fresh-water crabs in the Ceded Districts. A, swollen node, B, bamboo barrel; C, portion of the stick. (From Reddy, *Current Science*, v, p. 179, fig. 1, 1936.)
5. Photograph of a portion of the hooked stick used for pulling out *Scylla serrata* from its holes at Uttarbhag in the Gangetic Delta. (From Hora, *Current Science*, iii, p. 543, fig. 1, 1935.)

NOTES ON SOME NEW AND INTERESTING BUTTERFLIES CHIEFLY FROM BURMA.

BY

MAJOR-GENERAL SIR HARRY TYTLER[1], K.C.B., C.M.G., C.I.E., D.S.O.

PART I.

These notes were commenced in 1928 on my leaving Burma and return to England, but for various reasons, into which it is now unnecessary to enter, were never completed.

Some of the information may now be out of date and some butterflies discovered by me have in the meantime been described by other authors. On the other hand I have been able to work out my collection very carefully, and some of these notes will, I hope, be useful to Entomologists interested in the Butterflies from Burma.

The Butterflies from the extreme north-east of Burma are very little known, and any one who works this part of Burma systematically should derive a rich harvest.

I am greatly indebted to Capt. N. D. Riley, keeper of the Entomological Department, British Museum, for the great help he has afforded me and for the encouragement he has given me to finish and publish these notes.

I also wish to place on record my thanks to Mr. A. G. Gabriel, Assistant Keeper, Entomological Department, British Museum, for the help he has afforded me in comparing many doubtful forms with those in the National Collection and which greatly simplified my work.

PAPILIONIDÆ.

Troides helena ferrari, Tyt.

The female was described in the *J.B.N.H.S.*, vol. xxxi, p. 248 of August 1926.

Col. Ferrar, the late Chief Commissioner of the Andamans, found a male in a spider's web; the body was eaten out and only the wings remained.

It is very close to the male of *T. h. heliconoides*, M., but differs on both sides in having the yellow in the cell of hindwing extended right up to the extreme base and the yellow in interspace 7 is restricted, the edge starting well beyond the origin of v. 7; the yellow area in interspace 1 is also much restricted, and the inner edge of the terminal black spot in interspace 2 has its inner edge extended up to and touching v. 2 leaving no yellow area in between. There are no traces of any submarginal black spots on the yellow area of the hindwing. The ♂ type specimen was taken on Kondul Island, Nicobars on 11th March 1927 and was quite fresh. I have lately seen two beautiful males and three females in Col. Ferrar's magnificent collection. I am informed that although this insect is fairly often seen it is very seldom caught as it generally flies out of reach.

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[1] The author, Major-General Sir Harry Tytler, died on the 16th May 1939. An obituary notice appears on page 409 of this issue. The proofs of this part have been corrected by Mr. G. A. Talbot, F.R.E.S., who will also edit the second part.—EDS.

Polydorus doubledayi, Wallace.

The type came from Moulmein.

Hitherto all the forms flying in Burma have been placed under the name *P. doubledayi,* Wallace.

The forms flying in the north-east of Burma and in the south of Moulmein are by no means typical and are worthy of separation as subspecies.

There is a large series of both sexes before me from the Dawnas and from Rangoon.

Polydorus doubledayi putaoa, s.sp. nov.

Female type: Futao, N.-E. Burma.

This form is between *P. cacharensis,* Butl. and *P. doubledayi,* Wallace. The white spots on the hindwing are larger than the spots of the former (dry season form) but smaller than the spots of the typical form from Moulmein (dry season form). Two females of the dry season form were taken near Putao, in the extreme north-east of Burma, in April.

Polydorus doubledayi merguia, s.sp. nov.

Types: male and female, Victoria Pt., Mergui.

Both sexes differ from the typical form from Moulmein in having all the white spots on the hindwing smaller. I have not received this from further north than Tavoy. In the Dawnas its place is taken by typical *doubledayi,* Wallace. Described from eleven males and five females of the dry season form.

Polydorus latreillei ticona, s.sp. nov.

This race in both sexes is very close to *Polydorus l. kabrua,* Tyt. from Manipur and the Naga Hills.

It differs in having the white patches on the hindwing rather larger and closer up to the apex of interspaces 5 and 2. The apex of the cell has always slight indications of grey dusting, absent in Manipur and Naga Hills specimens; only in one specimen out of eight males and five females, from Manipur and the Naga Hills, is there any indication of this grey dusting.

Two ♂♂ and five ♀♀ were received from Hthawgaw, N.-E. Burma. The types are in my collection and paratypes ♂ and ♀ have been deposited in the British Museum.

Polydorus polla, de N.

Four males and two females of this rare butterfly were obtained at Sadon, N.-E. Burma, in July.

There is a male in the British Museum taken by the late Col. Bingham at Bernardmyo, which is a good deal further south.

Polydorus crassipes, Oberthür.

A male was taken in the Bhamo Hills in February, and a series of both sexes was obtained in the Kengtung State of the S. Shan States.

Polydorus nevilli, W.-M.

A series of this rare butterfly was obtained in the Kengtung State of the S. Shan States.

Chilasa slateri tavoyana, Butler.

The type was taken on the Thaung Yin River, E. Dawnas, on the borders of Siam.

The type was described from a specimen with all the blue discal streaks in the interspaces of the forewing upperside rather obsolescent; in average specimens from the Dawnas before me these stripes are rather more conspicuous, but there is one specimen in which the stripes are entirely wanting.

Specimens from the Karen Hills appear to belong to this race and not to *C. slateri marginata,* Oberthür, as considered by some authors; out of six specimens from the Karen Hills before me the discal streaks are quite wanting in four, quite typical in one, and as fully developed as in *C. slateri slateri,* Hew. in another.

C. slateri marginaat, Oberth. was described from specimens taken at Nam Ou between Upper Tonkin and Laos. There is a specimen in the British Museum which was taken on the Mekong River, S. Shan States, which agrees fairly well with Oberthur's figure but not altogether. The Mekong River does not actually cross the S. Shan States, but for a portion of its course forms the frontier between the Kengtung State and Siam, and is close to where Oberthür's type came from, and so it may be assumed that *marginata* does occur in the extreme east of the S. Shan States, but I am not so sure that it occurs further north; in any case the form occurring in the Karen Hills must be assigned to the race of *C. slateri tavoyana.* It is unfortunate that the name *tavoyana* should have been used for a form the type of which came from the Dawnas.

Papilio rhetenor publilius, Fruhst.

The late Mr. G. R. E. Cooper took a large series of this form in the eastern Dawnas in March. It differs from typical *rhetenor*, West. as follows :—

Male.—Hindwing much narrower. *Upperside*: forewing with the white tornal patch as in the variety *leococelis*, Jordan; hindwing with the blue scaling obsolescent or entirely wanting; the tornal spot in interspace 1 very conspicuous and placed on a large creamy white patch which extends into interspace 2; a separate creamy spot, generally in 3, below which and next to the termen there is a large creamy white spot in interspace 2 and a smaller one in 3; a still smaller one in 4 followed by a white edging to the termen between veins 5, 6 and 7.

Underside as in typical form but the edge of the termen between all the veins white.

There is a series of this form in the British Museum from Siam.

Papilio bootes mindoni, s.sp. nov.

Type: Hthawgaw, N.-E. Burma.

The male differs from *P. bootes mixta,* Tyt. in having all the white patches on the hindwing larger. The red tornal spot on the upperside is larger and completely surrounds the central black spot. On the underside the tornal red area is larger and generally narrowly produced along the dorsal magin as far as the upper end of the white patches.

Ten males were obtained at Hthawgaw, N.-E. Burma in June and July; of these the majority have the red extension along the dorsal margin.

Two male paratypes have been deposited in the British Museum.

Papilio protenor protenor, Cr.

The type came from China but no exact locality given.

A typical male form occurs at Loimwe in the extreme east of the S. Shan States. There are also before me typical males from the eastern Dawnas and the Ataran Valley; there is also a male in the British Museum from south-east Siam. The males from the north-west Himalayas agree with specimens from W. China, but I have no females before me from W. China so cannot compare them with north-west Himalayan females. I have a single female from Loimwe, where the typical male occurs, which is very near the form *euprotenor*, Fruhst. and not the same as the female of the north-west Himalayan form. Should the female from the north-west Himalayas agree with the female from China, as the male does, then we shall be faced with the curious fact of a quite different race, *euprotenor*, Fruhst., occurring between them.

Papilio arcturus dawna, s.sp. nov.

Male; very close to specimens before me from W. China, and only differs in the green band on the forewing being rather broader and so more conspicuous. It differs from the north-west Indian form *P. acturus arius*, Roth. on the *upperside*, in the green band of the forewing being narrower and not extending beyond interspace 3, and the blue batch on the hindwing being broader; on the *underside* of forewing the white area is broader especially in interspaces 2 and 3, as in W. China specimens, giving this area, on its inner edge, a convex appearance instead of being narrower and straight as in the north-west Himalayan form; on the hindwing the rufous tornal spot in interspace 2 is larger, extending upwards as far as or beyond the black tornal spot; this is also the case in the W. China form.

The type was taken at Dawna Taung 5,360 ft. on 2-1-1926 and a paratype also in the Dawnas in the same month.

Papilio polyctor significans, Fruhst.

The type came from Thandaung, Karen Hills. I have before me three males caught at Thandaung and these may be considered typical. Two males and a female were obtained at Kalaw, S Shan States, and a male near Maymyo, N. Shan States; in the latter the tornal white patch is not so well defined but otherwise is the same. Two specimens were also taken in the Naga Hills and are in all respects typical.

All these specimens are dry season forms and have the patch on the hindwing a bright *greenish blue.*

Papilio polyctor stockleyi, Gabriel.

Two specimens were taken by the late Mr. G. E. R. Cooper at Phadi, eastern Dawnas, at 2,000 ft. on 23rd March; the type was taken by Major Stockley at the Hotsprings, Melamoung, W. Siam, at 2,000 ft. on 15th April, and is in the British Museum.

This form has not previously been recorded from Burma.

Papilio krishna manipuri, s.sp. nov.

Male and female larger than the Sikkim form. On the hindwing upperside the blue patch is much narrower, and the portion of this patch in interspace 5 does not reach the base of the interspace as it does in all Sikkim specimens.

There are four males in the British Museum from Manipur, and Mr. Talbot, who kindly examined them for me, writes that three of them agree with the above description.

There are before me 25 ♂♂ and 5 ♀♀ which do not vary in any way.

It is by no means rare and many males were secured; the female appears to be very rare.

The ♂ and ♀ types were taken at Kabru, Manipur, 8,400 ft., in June 1912. It also occurs in the Naga Hills.

Paratypes ♂ and ♀ have been deposited in the British Museum.

Papilio krishna thawgawa, s.sp. nov.

Male larger than the typical form from Sikkim. On the *upperside* the pale macular band on forewing is broader and more greenish. On the *underside* the white band on forewing is much broader and on the hindwing much narrower and broken, and absent in interspace 3. Two males were taken at Hthawgaw, N.-E. Burma, on 27-7-27 and one of these, a paratype, was deposited in the British Museum. Mr. Talbot informs me that there are, in addition, in the British Museum, 'from Yunnan: Wei-sei-Bahand (Pere Ouvard) Ex coll. Oberthür) 2 ♂♂; from Lou-tse-kiang, 1901 (R. P. Genestier) Ex coll. Oberthür), 2 ♂♂. The Yunnan specimen only differ in the band of the forewing being more green than white and traversed by a dirty white line.'

Papilio xuthus, L.

A male and two females of the spring form *xuthulus,* Brem. were obtained in the Bhamo Hills at 6,000 ft. in May. It appears to be very local and I only came across it in one place. I have not seen the rainy season form *P. xuthus,* L. from Burma and it is possible only the spring form *xuthulus* occurs, it being single brooded.

Papilio machaon verityi, Fruhst.

The type came from Yunnan.

Dr. Jordan, in Seitz's work, p. 49, gives the habitat of *P. machaon verityi*

Fruhst as Upper Burma, Shan States, North Yunnan and adjoining parts of East Tibet, and states :—

'Differs from *sikkimensis* chiefly in the much narrower discal band of both wings. The tail is long; the abdominal margin of the hindwing is only narrowly black so that the area behind the cell and the median remains yellow for the most part.' He also gives as synonyms *archias*, Fruhst and *birmanicus*, Rothsch. He however makes no mention of the important difference, which is the total absence of the outer edging to the red tornal patch of the hindwing, so characteristic of this form. Rothschild in his description of *birmanicus* does mention its absence.

I possess a typical male taken at Kalaw, S. Shan States, at 5,000 ft. in October, and a male taken by the late Mr. G. E. R. Cooper at Taungyan, N. Shan States, also in October; the latter specimen is not quite typical as there are indications of black edging on the red tornal spot.

It is said to be not uncommon at Kalaw, but I have seen very few specimens from Burma altogether.

Papilio machaon suroia, s.sp. nov.

A large series of both sexes was obtained by my collectors at Suroi, Manipur, in 1913-1914 and I was under the impression, at the time, it was typical *P. machaon verityi*, Fruhst., but subsequently, on securing true *P. machaon verityi* in Burma, the differences were at once recognised.

It differs from *P. verityi*, Fruhst., in being larger, and in having the greater portion of interspace 1 of hindwing covered with long greyish-brown hairs; in *P. verityi* this interspace is almost entirely *clear yellow* with no long grey-brown hairs. It agrees with *P. verityi*, however, in having no black outer edging to the red tornal spot on hindwing. The absence of this outer black edging to the red tornal spot appears to be confined to this race and to *P. verityi*, Fruhst; all other forms from the Indian region appear to have it.

Paranticopsis macareus dawna, s.sp. nov.

Male: differs from *P. macareus gyndes*, Jord. as follows :—

Upperside: forewing: all white markings much narrower; the two white streaks in interspace 1 joining the two marginal white spots; hindwing: all the discal white markings as broad as in *gyndes*, but the post-discal streaks are wider, and continued to the marginal row of white spots which are very large; the whole forming a long continuous streak.

Underside: streaks on forewing narrow as on upperside, but the two streaks in interspace 1 not touching the two marginal spots; hindwing: ground colour uniform brownish, the marginal area not darker than the discal area; all pale markings as broad as on the upperside, but the post-discal streaks not quite touching the marginal spots except in interspace 1 and 1(*a*).

Several males were taken by the late Mr. G. E. R. Cooper on the Ta-ok Plateau, Dawna Range, at 4,000 ft. in April. One of the males kindly given me forms the type. There is also a male in the British Museum.

Meandrusa gyas aribbas, Fruhst.

A male of the rainy season form was taken at Hthawgaw, N.-E. Burma, in August, and two males of the dry season form in the Dawnas in April. The dry season males are very much lighter than the wet season form from Hthawgaw.

Meandrusa payeni amphis, Jordan.

Brig. Evans gives the locality for this form as North Burma. I have not received any specimens from that part of Burma but I have received a single male from the Karen Hills taken in March. It must be very rare in Burma.

Lamproptera indistincta amplifascia, s.sp. nov.

Male and female are very like *L. indistincta,* Tyt. but the pale bands on the wings are broader. A large series of males and two females were taken at Putao, Hthawgaw, and Sadon, N.-E. Burma, at about 5,000 ft. from June to October

The locality is interesting as the typical form has only been recorded from Manipur and the Naga Hills. Male paratypes have been deposited in the British Museum.

Armandia lidderdalii ochracea, s.sp. nov.

Male: Differs from the typical form, from Bhutan and the Naga Hills, in the pale markings across the wings being somewhat broader and more conspicuous. Female: all markings wider as in the male, but yellow and not white; the marginal yellow lunules on the hindwing in both sexes are reduced in size and more dusted with black. A large series of both sexes was taken at Putao and Sadon, E.-E. Burma.

Male and female paratypes have been deposited in the British Museum.

PIERIDÆ.

Aporia agathon bifurcata, s.sp. nov.

Somewhat similar to *A. agathon*, Gray, but constantly differs in having, through the cell of the forewing, a double dark line which is sometimes anastomosed in the middle, and in having a dark line, which becomes bifurcated towards the apex, running through the outer two-thirds of the cell of the hindwing.

A series of males and females was taken at Loimwe, S. Shan States, close to the Siamese border.

♂ and ♀ paratypes have been deposited in the British Museum.

Pieris naganum, Moore.

Four males of this rare species were taken near Sadon, N.-E. Burma, from August to October.

Pieris brassicae, L.

Brig. Evans, in his latest Identification of Indian Butterflies, gives the range of this common butterfly as Chitral-Assam, but makes no mention of its occurrence in Burma. It however occurs commonly at Loimwe in the extreme south-east of the Southern Shan States.

Delias aglaia aglaia, L.

The late Mr. Cooper showed me a male, in his collection from the Dawnas, which differed from the typical form in having the basal area yellow and not red.

Delias lativitta parva, Talbot.

Several males were obtained at Loimwe in the Kengtung State, Southern Shan States, in April and May. It appears to fly together with *D. patrua shan*, Talbot.

Delias lativitta naga, s.sp. nov.

This is an extremely dark form of *D. lativitta*; all the pale markings on both sides are very small, and the tornal area of the hindwing is black with no trace of yellow, resembling typical *D. berinda berinda*, M. in this respect.

Two males were taken in the Naga Hills in June and September.

A male paratype has been deposited in the British Museum.

Delias patrus shan, Talbot.

Mr. Talbot described the male from a series taken by my collectors at Loimwe, S. Shan States, in January-April and May, at about 5,000 ft.

The female is very similar to the male but all the pale markings on both wings, upperside, are much paler and more conspicuous, especially on the hindwing where the cell is entirely pure white.

In addition to the males mentioned above two females were taken. This sex appears to be very rare.

A ♀ neallotype has been deposited in the British Museum.

Delias belladonna lugens, Jordan.

Dr. Jordan, in 1925, separated the form of *D. belladonna* from Assam, Khasi Hills (type), Naga Hills; north-west Burma; S. Chin Hills under the name *lugens* and remarked '♂, ♀ not constantly different from *D. ithiela,* Butl. but the series of specimens darker, the white spots on the whole smaller, the orange anal patch absent above, very rarely indicated below.'

The above description agrees with the large series of males and females before me from the Naga Hills and Manipur, except in no case is there any trace of yellow below. On the other hand it does not agree with the race from Hthawgaw and Sadon in the extreme north-east of Burma; of this form 2 ♂♂ before me are typical *lugens* and 2 ♂♂ have yellow dusting at the anal angle above and below (*f. ithiela*).

As Hthawgaw and Sadon the two distinct forms of *lugens* and *belladonna* fly together.

Delias belladonna, Fabr.

Mr. G. Talbot, who has lately written a monograph on the genus *Delias*, considers the distribution of *D. belladonna* to be as under:—

N.-W. Himalayas—*horsfieldii*, Gray.
Sikkim and Bhutan—*ithiela*, Butl. (*f. horsfieldii*; *f. lugens*).
Assam (Naga Hills, Khasi, and Lushai)—*lugens*, Jord. (*f. ithiela*).
North Burma (Upper Shan States)—*lugens,* Jordan.
Central and Southern Burma—*hedybia,* Jordan.
Eastern Burma (Bhamo; Sadon)—*belladonna*, Fabr.
Yunnan—*belladonna*, Fbr.
North Yunnan (Chinese border)—*zelima,* Mitis.
South China—*kwantungensis,* Talb.
Central and West China—*zelima*, Mitis.
Tonkin—*belladonna,* Fabr.
Siam—*hedybia,* Jordan.
Malaya (Perak)—*hedybia,* Jordan.
Malaya (Pahang)—*malayana*, Pendl.

There are before me 9 ♂♂ from Sadon and Hthawgaw, in the extreme north-east of Burma which, according to the above distribution, should be typical *D. belladonna,* Fabr. They differ from the form before me from Kalaw, Loimwe, S. Shan States, and the Dawnas which, in accordance with the above distribution should be *D. belladonna hedybia,* Jord., in being larger, and on the underside the yellow spots in the cell and margin of hindwing also larger.

Mr. G. Talbot, in a letter dated 6-10-28, gives the following differences by which *zelima,* Mitis can be separated from *hedybia,* Jordan:—

'This race (i.e. *hedybia*) has smaller spots on the hindwing below and the cell spot especially tends to be smaller. The ♀ *hedybia* has more yellow on the hindwings than *zelima*; the patch in cellule 2 is large and not pale by white admixture which is the case in *zelima.* Most females of *zelima* have a pale yellow and mostly white anal patch, and the spot in 2 is smalller than in *hedybia* ♀. . . . . There is no doubt that *zelima* and *hedybia* are distinct races.'

The above differences also apply to the race *belladonna* from Hthawgaw and Sadon with the exception of the differences noted above between *belladonna* and *hedybia.*

The four males of *D. belladonna lugens,* previously mentioned as taken at Sadon and Hthawgaw, were taken flying with the *D. belladonna belladonna,* Fabr. It is curious that two such distinct races should occur together.

There are also before me 2 ♂♂ of *D. hedybia* from Kalaw; 20 ♂♂, 4 ♀♀ from Loimwe, S. Shan States; and one ♂ from the Dawnas. These all agree with one another and I can see no difference.

Delias sanaca perspicua, Frust.

Four males received from Hthawgaw, N.-E. Burma, in June, where it appears to be rare. In appearance it is very like *D. berinda boyleae,* Butler, but is rather a darker insect, with the white spots smaller; the genitalia are however quite different.

Delias berinda berinda, M.

Two forms fly in the Naga and Manipur Hills. In the first form the upperside is very dark and white markings not very conspicuous. In the second form the upperside is much lighter and all the grey markings much larger and more conspicuous.

Delias berinda boyleae, Butl.

I received a large series of a Delias from Loimwe, S. Shan States, taken in March and April, which I thought were *D. sanaca perspicua,* Fruhst., but on sending a series to Mr. G. Talbot he writes:—(21-12-28). 'I have recently been examining the species of Delias which you kindly included in your lot under the name of *perspicua.* I find that all these specimens belong to *berinda boyleae*, Butler. The similarity of the two species is very remarkable and I hesitated to be certain of the correct indentification until I had examined the scent scale or the uncus. The long middle lobe of the uncus is a decisive character for the *berinda* forms. The scent scale is shorter than in *D. sanaca perspicua.* It seems that *perspicua* is a rare species, and as regards pattern the discal spots of the hindwing are usually smaller than in *boyleae.*'

Delias berinda cooperi, s.sp. nov.

A single specimen was taken at Hthawgaw, N.-E. Burma, in June.

It is very like the light form of *D. berinda berinda* referred to above, and the genitalia is the same.

It differs, however, in having the yellow basal spot longer and pointed along the costa instead of being round. On the underside, the streak in the cell is shorter, and all the discal spots larger. On the hindwing upperside there is a dusting of yellow at the tornal angle, and on the underside there is also a yellow dusting at the tornal angle and along the inner margin.

Appias lalage lalage, Moore.

Three females are before me from Loimwe, S. Shan States. Probably more males and females were sent me but remain unset amongst my duplicates. This form has not previously been recorded from the S. Shan States.

Dercas verhuelli, Hoeven.

The following forms occur in the distribution of this species in the Indian and Burman areas.

(*a*) *Dercas verhuelli doubledayi*, M.; the type came from Sikkim and the female is *yellow.*

(*b*) *D. verhuelli naganum*, s.sp. nov., from the Naga Hills and Manipur, has a slightly larger female which is *creamy white*, a yellow variety (*f. doubledayi*, M.) occurring very rarely.

(*c*) The form from N.-E. Burma had better for the present be included in (*b*) until more specimens are obtained. Of the 5 ♀♀ before me three are creamy white (*f. naganum*) and 2 ♀♀ are yellow (*f. doubledayi*).

(*d*) *D. verhuelli shania*, s.sp nov. from Maymyo, N. Shan States, and Loimwe, S. Shan States, is rather smaller in both sexes than the forms (*a*), (*b*) and (*c*), but not as small as the next form *D. vehuelli parva*, Evans. The male has a blunted apex to the forewing, and the female is *yellow* (*f. doubledayi*).

(*e*) *D. verhuelli parva*, Evans; this is the smallest form, with very blunted apices to the forewings of the males; the female is *said* to be white, but I am unable to verify this as in the long series of males in the British Museum, given by Brig. Evans, there are no females.

DANAIDÆ.

Danaus aventina purpurascens, sub. sp. nov.

The type of *D. vulgaris*, Butler, though labelled Nepal, is considered to have really come from Java, and the South Burma form, which agrees with the Siamese form, should be known as *D. aventina macrina* Fruh. This latter form has not been recorded further north than Rangoon.

A rather distinctive form, however, occurs in N.-E. and N. Burma, which differs from the southern form, *macrina* on the underside, in having the apex of the forewing and the whole of the hindwing suffused with pinkish mauve.

It is common in the Hukong Valley, N.-E. Burma, in April; a female was also taken at Kanti on the Chindwin River, North Burma, in September. There are also three females in the British Museum collection from the Jade Mines, N.-E. Burma.

Two pairs, paratypes, have been deposited in the British Museum.

Euploea deione deione, Westw.

A varietal form has the apex suffused with bluish streaks as in the ♀ varietal form *myetalius* of *Euripus halitherses*.

I propose calling this form *v.* **suffusa**, nov.

Three specimens are before me from widely separated areas.

♂ type Khasi Hills; ♀ type Sikkim.

It also occurs in Manipur where a ♀ was taken at Sebong.

Euploea diocletiana talboti, s.sp. nov.

The name *Euploea diocletiana*, Fab. has hitherto been used for all forms from Assam to South Burma.

The type of *diocletiana,* Fab. was probably described from Siam or Indo-China. The form from South Burma agrees with the form from the Malay States and is undoubtedly *E. diocletiana,* Fab.

The form from Assam, the Naga Hills, and Upper Burma, differs from the South Burma form and forms a new subspecies for which I propose the above name.

Male and female much larger.

Male: upperside very like the typical forms but the white markings on the hindwing slightly broader and the spot in interspace 3 larger.

Female: upperside much darker than the typical form, with the blue colouration on the wings much more developed, and on the apex of forewing nearly as vivid as on the apex of the forewing of the male.

Types ♂ and ♀, from the Naga Hills, are in my collection.

Euploea harrisi hopei, Fd.

Brig. Evans gives the range of this form as Sikkim—Shan States, and of *E. harrisi harrisi* as Karen Hills—S. Burma. I have not seen the latter north of the Dawna Range. There are, however, two intermediate forms flying together equally commonly in the Karen Hills.

The first form is very like *E. harrisi hopei*, Fd. on the forewing, but the spots on the hindwing are much more developed.

The second form is very like *E. harrisi harrisi* on the forewing, but the post-discal spots on the hindwing are smaller and not so distinct.

Euploea midamus splendens, Butl.

Brig. Evans gives the range of this insect as Sikkim—Shan States. I have taken a large number of *E. midamus* in the Karen Hills, and of fourteen set specimens now before me, twelve belong to the *splendens* form and two males to the *margarita* form. There are specimens of the *splendens* form in the British Museum from as far south as Rangoon.

Euploea midamus margarita, Butl.

The name *margarita*, Butl. has precedence over *brahma*, Moore.

The types of both forms are from the same place—Moulmein—and are identical.

Although this insect begins to appear in the Karen Hills it is very rare there, and only occurs as a variety, and does not become a definite race till Moulmein and the Dawna Hills are reached.

It also occurs in the Nicobars where Col. Ferrar has taken a single female on Kamorta Island in July.

SATYRIDÆ.

Mycalesis anapita, M.

Three males and two females were obtained by my collectors in Mergui in April and June 1927. The late Mr. G. E. R. Cooper also had several specimens in his collection from the same place.

The type came from Sumatra.

It had not, I believe, been previously recorded from Burma.

Brig. Evans, in his *Identification of Indian Butterflies*, 2nd ed., records having received specimens taken by Mr. D. C. Ollenbach.

Mycalesis suavolens konglua, s.sp. nov.

Male. *Upperside*: both wings very like *M. suavolens sebonga*, Tyt. but the two narrow terminal lines on hindwing much whiter. *Underside*: discal band on both wings much wider; the area between this band and margin paler than the rest of the wing, and slightly washed with grey towards the tornal angle of hindwing, ocelli rather larger. A single male was taken in June at Konglu in the extreme north-east of Burma.

Mycalesis mestra sadona, s.sp. nov.

Type male and female, Sadon, N.-E. Burma.

This form differs from the typical *Myc. mestra mestra*, Hew., from Cachar, in having all the pale markings on both wings, upper and lower surfaces, broader and more conspicuous, especially so in the female. On the upperside the submarginal pale band on hindwing, in both sexes, is pure white and not dusky white.

Fruhstorfer separates the Sikkim form under the name *vetus*. I have not seen this form.

Three males and five females were taken at Sadon and Hthawgaw, N.-E. Burma, in June, July, October and November. A female was also taken in the Naga Hills in September.

Male and female paratypes have been deposited in the British Museum.

Lethe brisanda, de N.

Type from Bhutan.

Two males were taken at Hthawgaw, N.-E. Burma. It has not, I believe, been previously recorded from Burma.

Lethe sadona, Evans.

Brig. Evans described this form as a race of *L. brisanda*, de N.

The markings are somewhat similar but the male differs in the following respects:—

Upperside: hindwing: there is a tuft of up-turned black hairs, arising along the middle of the cell, and directed towards the costa.

Underside: forewing: the pale transverse bar in the cell is broader and not so well defined; the transverse pale discal band is also broader and directed to the tornal angle and not to the inner margin as in *L. brisanda*.

The genitalia are different, the tegumen in *brisanda* is sharply bent down in the middle whereas in *sadona* it is tapering and more or less straight.

A fair series of males was taken by my collectors at Sadon, N.-E. Burma. I have also received two specimens of *L. brisanda*, de N. from Hthawgaw, which is south of Sadon. It is, therefore, more than likely the two forms fly together at Sadon.

It is better to consider *sadona* a good species and not as a race of *brisanda*. ♂ type is in the British Museum.

Lethe serbonis pallida, s.sp. nov.

Male and female smaller than *L. serbonis naganum* Tyt. from the Naga Hills. Upper and lower sides paler, especially on the underside where it is much paler.

A male and female were obtained at Hthawgaw, N.-E. Burma, in July.

Lethe christophi, Leech.

A male was taken at Hthawgaw in September. It appears to be very rare in N.-E. Burma.

The type came from Mupin, China.

Lethe nicetas nicetas, Hew.

Four males were taken at Hthawgaw, N.-E. Burma, and are identical with specimens from Sikkim. It has not, I believe, been previously recorded from Burma.

Lethe maitrya thawgawa, s.sp. nov.

The male differs on the underside, from the typical form *L. maitrya*, de N., in having no bar at the apex of the cell of forewing; all the markings are not so prominent.

Five males were obtained at Hthawgaw in July. This is an extremely interesting capture as no race of *L. maitrya*, de N. has, I believe, been previously recorded east of Sikkim.

♂ paratype has been deposited in the British Museum.

Lethe visrava, M.

Nine males and a female were obtained at Hthawgaw, N.-E. Burma, and a female in the Kengtung State of the S. Shan States, where it appears to be very rare.

The female appears to be very rare.

This species has not previously been recorded from Burma.

Lethe dakwania, sp. nov.

Upperside: male and female very much like *L. sidonis* but much paler, the submarginal black spots well defined.

Underside: very pale brown; the post-discal band of *forewing* better defined, pure white near the costa, and extended downwards as far as *v.* 1 in the male and to the dorsal margin in the female; *hindwing*: discal markings pale brown and ill defined; the submarginal ocelli smaller, and surrounded either with pale brown or sometimes with very pale violet.

The genitalia of the male of *L. dakwania* and *L. sidonis* are different.

In *L. sidonis* the uncus, as seen from the side, is distinctly raised, and higher and thicker in the middle, and then sharply bent downwards. In *L. dakwania* the uncus is *evenly* curved and not thicker and raised in the middle, or suddenly bent downwards.

A large series of males and females were taken at Dakwani, Eastern Garhwal, at about 9,000 ft. in August 1914.

Paratypes have been deposited in the British Museum.

Lethe violaceopicta burmana, s.sp. nov.

A single male was taken at Sadon, N.-E. Burma, in October. It appears to be very close to *L. kanjupkhula*, Tyt., from Manipur; from this it differs in the forewing not being so pointed. On the underside the row of apical spots are reduced to pinpricks; the submarginal spots on hindwing are very much smaller, and the ternal area has only one spot and not two.

Lethe goalpara kabruensis, sub. sp. nov.

The form from the Naga Hills and Manipur is distinct from the typical form from Sikkim, and forms a well marked race.

On the underside all the markings are darker, and the basal area is suffused with brown and is much darker than the Sikkim example.

A good series of males and females was obtained in the Naga Hills and Manipur. The occurrence of this form in the Naga Hills was first recorded by me in the *J.B.N.H.S.*, October 1911, vol. xxi, p. 53, but was not separated as a sub-species.

♂ and ♀ paratypes have been deposited in the British Museum.

Lethe dura dura, Marshall.

One male of this rare butterfly was obtained at Kalaw, S. Shan States, in October, and two males at Loimwe, in the Kengtung State at the extreme southern edge of the S. Shan States, in June.

Lethe dura mansonia, Fruh. Three males of this very rare butterfly were obtained on the Dawna Range in April.

Lethe pulahina, Evans.

Two males were obtained at Hthawgaw in July.

Lethe moelleri bruno, s.sp. nov.

Two males were obtained at Hthawgaw, N.-E. Burma. They differ from the typical form from Sikkim in being much darker below, and in the complete absence of the pale marginal line on the underside of both wings. This is an interesting capture as the collective species has not been recorded east of Sikkim.

Lethe andersoni, Atkinson.

Four males of this very rare butterfly were obtained at Hthawgaw, N.-E. Burma, in September.

Pararge satricus kabrua, s.sp. nov.

The prevailing form, occurring in Manipur and Naga Hills, is very much darker than the form from Sikkim and Bhutan. The lighter form, like the Sikkim form, also occurs but rarely.

Before me are fourteen males and ten females of the dark form, whereas there are no males and only five females of the light form.

I propose naming the dark form as above and treating the pale form as a variety.

♂ and ♀ paratypes have been deposited in the British Museum.

Pararge praeusta burmana, sub. sp. nov.

The male is larger than *P. praeusta*, Leech, from N. China.

On the upperside, it differs in having the orange band on the forewing much broader and continuous, and not broken in interspace 3; in *praeusta,* Leech this band is very narrow and completely broken in interspace 3.

On the underside the colouring is altogether darker and brighter. On the hindwing the conspicuous white crescent, bordering the inner edge of the subapical spot, is wanting, and replaced by an indistinct crescent of the same greyish colour as the ground colour of the basal and discal area.

Specimens in the British Museum from Yunnan are closer to this form than to the typical form from further north.

Two males were taken at Hthawgaw in August.

♂ paratype has been deposited in the British Museum.

Aulocera padma thawgawa, s.sp. nov.

Types, male and female, Hthawgaw, N.-E. Burma.

Male and female differ from the typical form in being very much larger and much darker. On both surfaces the white band on both wings is much broader, and on the underside the white striation is very distinct and carried right up to the base of the hindwing.

Three males and a female were obtained at Hthawgaw, N.-E. Burma, in August.

Aulocera loha japroa, sub. sp. nov.

Types, male and female, Japro, Naga Hills.

Male and female on upper and lower surfaces, somewhat similar to *Aulocera loha*, Doh. from the western Himalayas, but the white fascia on both wings broader. On the underside it is much darker and the white striation more extended and pronounced. On the upper and lower surfaces the white bands are broader than in *Aulocera chumbica,* M.; on the underside it is much darker, and the bands of fore and hindwings are of equal width; in *chumbica* the band on the underside is wide on the forewing and narrow on the hindwing.

Two males and three females were taken in the Naga Hills, and three males and one female in the Manipur Hills at Suroifui in September and October. A male was also taken at Fort White in the Chin Hills which, however, is not quite typical, and is nearer *Au. loha*, Doh. as regards the striation on the underside.

Erebia orixa watsoni, Watkins.

The type and other specimens from the Chin Hills, taken in May and June, are in the British Museum. They differ from specimens taken by my collectors at Fort White, Chin Hills, in September, in having the underside much paler and the discal and marginal bands much more pronounced.

I can see no difference between the specimens taken in the Chin Hills in September and specimens of *E. annada orixa*, M. taken in the Chin Hills during the same month. The occurrence of this form in the Chin Hills as early as May and June is surely unusual. In the Naga and Manipur Hills both *orixa* and *suroia* occur in August-October, very rarely in July.

Erebia suroia, Tytler.

Four males were obtained at Hthawgaw, N.-E. Burma, in July. They do not differ from the typical form from Manipur except that one specimen has two small tornal spots on hindwing underside and one small spot on one side only. The other two specimens have no spots.

This is an interesting capture and extends the range of this race to N. Burma. Brig. Evans records the range of *orixa* as Assam—North Burma, but I have not come across it in four years' collecting in N.-E. Burma unless he refers to the aberrant form of *suroia* with two spots.

Erebia narasingha dohertyi, Evans.

Four males of this rare butterfly were obtained at Hthawgaw, N.-E. Burma.

Ypthima megalomma megalia, de N.

A single male of this very rare species was obtained in the Bhamo Hills in February.

Ypthima dohertyi persimilis, Elwes.

Four males of this very rare butterfly were obtained at Sadon, N.-E. Burma, in October.

Erites falcipennis, W. M.

A single male was taken in the Karen Hills in February. This is an interesting capture as it has not previously been recorded from Burma.

Erites rotundata, de N.

A male and female were taken in Maymyo, N. Shan States, in January. Brig. Evans does not give its locality north of the Karen Hills; so its occurrence at Maymyo extends its range northwards considerably.

Coelites epiminthia epiminthia, Westwood.

The late Mr. Cooper obtained a male of this form in Margul. I had an opportunity of examining it and it is undoubtedly true *epiminthia,* Westw. This is an interesting capture as it has not been recorded so far north before as Mergui.

Coelites epiminthia calverti, sub. sp. nov.

This form differs from *C. epiminthia binghami,* Moore on the underside of forewing having the submarginal band narrower, with sharper edges, and rather closer to the termen; the band on the hindwing is also much narrower and is not produced beyond v. 2; the violet gloss so conspicuous in *binghami* is almost absent in this form.

The late Mr. Cooper received several specimens from Arrakan, and these were named by him *calverti* after Mr. Calvert who collected them for him. I am unaware whether a description was ever published by him and in case not I propose the above name.

A male kindly given me by Mr. Cooper is now in my collection.

Neorina patria westwoodi, M.

Brig. Evans gives the range of this species as Assam—N. Burma. I have received several males from the extreme N.-E. Burma, Bhamo, and one male from Loimwe in the Kengtung State close to the Siamese border. This extends its range considerably to the south.

Melanitis zitenius anisakana, s.sp. nov.

Both sexes much smaller than typical *zitenius,* Herbst. and the apical fulvous patch on forewing smaller and not nearly so conspicuous. The apex of the forewing not so truncate.

Some male specimens approach *M. zitenius gokala,* M. from South India.

The late Mr. G. E. R. Cooper obtained a large series of both sexes at Anisakan near Maymyo in July and September 1926, of which he very kindly give me 4 ♂♂ and 2 ♀♀. There is also a male before me taken at Sebong, Manipur, in July 1913.

♂ and ♀ paratypes have been deposited in the British Museum.

Elymnias penanga chelensis, de N.

A single male of this very rare butterfly was obtained in the East Dawnas.

Elymnias pealii, W.-M. Five males and a female of this rare butterfly were obtained on the Putao Road, N.-E. Burma, in March.

Elymnias dara daedalion, de N. A male was obtained in the Karen Hills. Brig. Evans gives the range of this insect as Dawnas—S. Burma.

AMATHUSIIDÆ.

Faunis eumeus burmana, s.sp. nov.

The form from N.-E. Burma differs from *F. assama,* Wd. in having both the upper and lower surfaces dark sepia brown and not fulvous brown.

On the *underside* of forewing the discal and submarginal lines are much apart and parallel, and do not converge and meet at v. 1 as in *assama*; the spots between these two bands are much smaller.

A single male was obtained at Sadon, N.-E. Burma, 6,000 ft. in September 1926.

Faunis eumeus incerta, Stdgr. A single male was taken at Loimwe, S. Shan States, in December 1924. It appears to be very rare and I believe it has not been recorded from Burma before.

Faunis caneus subpallida, s.sp. nov.

Male and female: *upperside* very similar to *Faunis caneus* Hübn.; on the *underside* the outer third of the apical area of the forewing is conspicuously paler than the rest of the wing.

Three males and one female were taken at Loimwe, S. Shan States, in December and May.

One of the males taken in December is normal and lacks the pale area.

Aemona lena, Atkinson.

The type came from West Yunnan and was taken by Dr. Anderson in 1862 during the Yunnan Expedition in the south-west of that Province.

Two males taken at the same time are in the Indian Museum, Calcutta, and as they are said to agree in all respects with Atkinson's type figure it may be assumed that his figure represents a male although not stated to be so.

Wood-Mason, as quoted by de Nicéville, stated that specimens taken by Major Marshall in Tenasserim agreed with the Yunnan specimens in the Indian Museum (*Butterflies of India*, vol. i, p. 302), except that the three white spots on the anterior half of the hindwing are larger, forming a band divided by the veins.

I do not, however, think the Tenasserim form can be typical for reasons given below.

The collective species covers a wide area from West Yunnan, the Bhamo Hills, through the Northern and Southern Shan States, the Karen Hills to Upper Tenasserim and Siam.

The Bhamo Hills form a narrow strip of hills running from the Irrawadi River north to the border of Yunnan. The expedition in 1862 must have entered Yunnan by the valley of the Taping River which is the main caravan route from Burma into W. Yunnan. The Taping valley runs through the Bhamo Hills, and the river joins the Irrawadi River at Bhamo.

The form from the Bhamo Hills may therefore be assumed to be typical *Ae. lena*, Atk.

The forms occurring between Bhamo and the Salween River and Siam may be divided into the following local races or subspecies:—

Aemona lena lena, Atkinson; Type, S.-W. Yunnan.
Aemona lena haynei, Tytler; Types ♂ and ♀ Maymyo.
Aemona lena kalawrica, s.sp. nov.; Types ♂ and ♀ Kalaw.
Aemona lena karennia, s.sp. nov.; Types ♂ and ♀ Karen Hills.
Aemona lena kengtunga, s.sp. nov.; Types ♂ and ♀ Loimwe.
Aemona lena salweena, s.sp. nov.; Type ♂ Salween River.

Aemona lena lena, Alkinson. Mr. A. G. Gabriel, Assistant Keeper of the Entomological Department, British Museum, who very kindly compared Atkinson's figure on my behalf with Karen Hills specimens in the British Museum, makes the following remarks:—

'Atkinson's figure is a male (sic) said to be from Western Yunnan. . . . We have nothing quite like it in the British Museum as it is uniformly dark along the outer area of the forewing (except for the pale markings in the interspaces), whereas the Karen Hills form with which it most nearly agrees, tends to become paler towards the forewing tornus.'

There are before me six males and three females of the dry season form from the Bhamo Hills. The males differ from the Karen Hills dry season form in having the forewing much more suffused with greyish, giving the wing a darker appearance. This agrees with Mr. Gabriel's statement regarding Atkinson's figure. The females are very much darker than the females from the Karen Hills; the whole of the forewing up to the post-discal band and base of the hindwing being suffused with grey; the white spots in the interspaces of the outer area of the forewing are clear white, and stand out conspicuously on the dark area on both sides of the post-discal band. I have seen no wet season forms from the Bhamo and Karen Hills.

Aemona lena haynei, Tytler. A description of this very distinct form which occurs in Maymyo, N. Shan States, was given in the *J.B.N.H.S.,* in August 1926 and no further remarks are necessary.

Aemona lena kalawrica, s.sp. nov.
The male does not differ from the Karen Hills form but the female is very different. The wings are suffused with grey as in the typical form from Bhamo, but all the dark markings, along the veins and along the termen of both wings, are very much darker, almost black, contrasting with the white interspaces on the outer area of both wings.

Described from one male and two females of the dry season form from Kalaw, S. Shan States.

Aemona lena karennia, s.sp. nov.
The form from the Karen Hills is well known, and has hitherto been considered to represent Atkinson's insect from Western Yunnan but wrongly so for the reasons given.

There are eight males and a female in my collection, and a series of males and females in the British Museum.

The types are in the British Museum collection.

Aemona lena kengtunga, s.sp. nov.
The form from Loimwe, in the extreme south-east of the Southern Shan States, differs from the typical form from Bhamo in the male and female being much smaller, and in having the forewing still more suffused with grey; in some males this grey covers the whole of the forewing.

The seasonal forms differ somewhat; the wet season form being rather darker than the spring form.

Described from eleven males and four females of the dry season form and eleven males and three females of the wet season form in my collection.

Paratypes have been deposited in the British Museum.

Aemona lena salweena, s.sp. nov.
Type: Papun, Mal-hong-song, Salween District, Upper Tenasserim (A. C. Harman), is in the British Museum; also a paratype in the British Museum from Bangkok, Siam (Dr. E. Milford Barnes); there is also a paratype in the British Museum from Melamung, W. Siam, taken by Major C. A. Stockley in April 1920.

This form is between *Ae. lena karennia* and *Ae. haynei,* Tyt. All the pale markings tend to be obliterated, but not so much as in *haynei.*

This may be the form recorded as having been taken by Major Marshall in the Thoungyeen Forests, Upper Tenasserim, in April. It is certainly not the same as the Karen Hills form or the typical one from Bhamo.

Aemona amathusia, Hew.

Five males and a single female were obtained at Putao and Sadon, N.-E. Burma.

It has not been recorded hitherto east of Assam and the Naga Hills.

Stichophthalma nourmahal, Westw.

A single female was obtained at Sadon, N.-E. Burma. This considerably extends its range to the east and into Burma.

Stichophthalma camadeva aborica, s.sp. nov.

Male: *upperside* rather similar to *camadeva nicévillei,* Röb. from the Khasi Hills, but the post-discal band on the hindwing is very small and the spots narrow. *Underside* similar to *nicévillei,* Röb. but the ground colour is a warmer brown.

A single male was received from the Abor Hills, taken during the expedition in July 1913.

Stichophthalma camadeva burmana, s.sp. nov. Male and female very similar to *camadeva nicévillei,* Röb. from the Khasi Hills, but the ground colour on the *upperside* is very much darker, especially so in the male;

on the forewing there are four black post-discal spots; in all the other *camadeva* forms I have seen there are generally only three such spots—sometimes fewer; four spots are the exception; on the hindwing the purple post-discal spots are darker, smaller and narrower.

On the *underside* the ground colour on both wings is darker and of a richer brown; on the *forewing* the discal band is much narrower, especially towards the costa, and is not continued below v. 2.

Two males and a female were taken at Hthawgaw in July 1927.

A male paratype has been deposited in the British Museum.

Thauria lathyi lathyi, Fruh.

The type came from Tonkin.

Two males were taken at Loimwe, S. Shan States, close to the Tonkin frontier, and agree with the co-types in the British Museum. It has not previously been recorded from Burma.

Specimens of *T. lathyi amplifascia,* Roth. differ but slightly from *lathyi,* Fruhst. in having the white band on the forewing broader.

In N. Burma it is apparently rare. I have seen no specimen of *Th. lathyi amplifascia,* Roth. south of the Bhamo Hills where one specimen was obtained.

Thauria aliris merguia, s.sp. nov.

Brig. Evans, in his latest edition of *Indian Butterflies*, gives the range of *T. aliris intermedia*, Crowley as N. Burma, and of *T. aliris pseudoaliris*, Butler as the Karen Hills—S. Burma.

The type of *T. aliris intermedia,* Crowley is in the British Museum with the label *Burma* but without further exact locality; it, however, probably came from the Karen Hills, or possibly from the Dawnas, as *all* specimens I have seen from the former locality and *some* from the latter, agree with the type.

I have seen no specimen of *intermedia* from north of the Karen Hills and if it does occur there it must be very rare.

Most specimens from the Dawnas, and specimens from Mergui, on the other hand, have the band on the forewing narrower and form a distinct subspecies; they cannot be *T. aliris pseudoaliris,* Butler, the type of which is in the British Museum and came from Malacca, and which has the band yellowish and not white. I propose the above name for this subspecies.

Male type, Mergui; female type, Ataran Valley.

Thaumantis diores splendens, s.sp. nov.

The dry season form from the Karen Hills and the Dawnas differs from the dry season form in North Burma and Assam in having the blue suffusion rather more vivid and extensive, reaching the termen of the forewing. The pale outer whitish area on the blue patch of the forewing is more silvery, and wider, especially in interspace 3, where in the typical form it is more constricted and hardly fills the interspace at all.

Described from 7 ♂♂ and ♀♀ now before me, and a large series of both sexes in the British Museum.

Several specimens of typical *T. diores* were taken in N.-E. Burma.

♂ and ♀ types have been deposited in the British Museum.

Thaumantis lucipor, Wd.

Four males and four females of this very rare and beautiful butterfly were taken in Mergui.

Zeuxidia doubledayi chersonesia, Fruh.

A single female of this very rare form was obtained as Myankhamba in April.

Zeuxidia aurelius, Cr.

Several specimens of this beautiful butterfly were taken by the late Mr. G. E. R. Cooper at Hangapru, Mergui, in April.

Discophora deo, de N.

A single male of this very rare butterfly was taken at Loimwe, S. Shan States.

In the *J.B.N.H.S.*, November, 1914, I erroneously recorded the capture of a male of this species in the Naga Hills. On comparing these two forms marked differences were at once apparent. The Burma form proved to be true *D. deo,* de N. and the Naga Hills form will require a new name.

Discophora deo deodoides, s.sp. nov. Male: larger than *D. deo*; tornus of hindwing more produced. *Upperside*: forewing with a broad yellow post-discal band, something like that of *D. deo*, but evenly curved and not bent down sharply at v. 5; the lower end of the band, in interspace 2, divided from the band above by v. 3 which is black; two large yellow spots, in interspaces 2 and 3, between the yellow band and the termen; a large patch of conspicuous, silvery mauve, specialized scales, entering the cell and reaching v. 1; the veins crossing this patch are dark and contrast with the lighter colour of the patch; hindwing: a black discal patch of specialized scales as in *D. deo* but larger and crossed by lighter veins.

Type: Nichuguard, Naga Hills, February 1914.

(To be continued).

STUDIES ON *LAPHYGMA EXIGUA* HB. AND ITS NATURAL ENEMIES.

BY

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INTRODUCTION.

The caterpillars of *Laphygma exigua* Hb., belong to the well-known family of cutworms (*Noctuidae*) which are known to devastate growing crops. According to Lefroy[1] this insect enjoys a world-wide distribution, being found in Europe, South Africa, North and South America, Oriental regions, and Honolulu. In India, it is distributed throughout the hills as well as the plains. Fletcher[2] has recorded a wide range of host plants such as lucerne, indigo, onions, chillies, gingelly, cowpea, brinjal, radish and Amaranthus in South India. Subsequently, Ramachandra Rao[3] has recorded it as a serious pest on Daincha (*Sesbania aculeata*), turmeric, maize and castor; he[4] has also noted it as a pest on ragi (*Eleusine coracana*) nurseries, and ganja plants (*Cannabis sativa*). It has also been further noted on coriander, sorghum and agathi (*Sesbania grandiflora*). More recently it was noted on cotton by the authors. In North India, Fletcher[5] has recorded it on a large variety of economic plants. Recently, the pest has come to attract a good deal of attention from the India Leaf Tobacco Development Company whose extensive tobacco nurseries at Chirala (Guntur District) were invariably subjected to severe damage every year in the early stages, by the caterpillars. Up till now there has been no record of the above caterpillars being noted as a pest on tobacco nurseries in South India. This is the first record of its kind. At the request of the Company, preliminary investigation was first made in 1936 with a view to study the pest and suggest control measures. The present paper gives a short account of the results of these investigations.

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[1] Lefroy, *Memoirs Dept. Agri. Ent. Ent. Ser.*, vol. i, p. 173.

[2] Fletcher, *Some South Indian Insects*, p. 378.

[3] Ramachandra Rao, *Madras Govt. Entomologist's Annual Report*, 1924-5.

[4] *Ibid*, 1928-9.

[5] Fletcher, *Proc. 3rd Ent. Meeting*, vol. i, p. 70 (1919).

Tobacco Nursery and Preparation at Chirala.

A general account of the nature and extent of nursery cultivation at Chirala is given so that it is possible to know the environmental conditions under which the caterpillars assume pest form year after year.

Nurseries are raised over an extensive area of about 70 to 90 acres at a time, and as large an area is kept fallow for sowing in the next season. Being near the sea coast, the soil is nothing but pure sand and hence the most easily drained. Compost and redried tobacco stems are applied to the beds in fairly large quantities as manure. The beds are rectangular measuring nearly 45 ft. by 5 ft.; they are laid close together in parallel series, 12 inches apart. Preliminary cultivation is done as early as June. Sowing commences early in August and is kept going till the end of the month. *Harrison Special* and *White Burly* are the two types of tobacco used extensively for raising the nurseries. Redried tobacco stems are strewn on the top of the beds with the double object of protecting the tender germinating seedlings from the scorching sun and preventing water scouring away the soil at the time of irrigation.

Irrigation is done by overhead splashing of water; this is done five times a day from early dawn to late in the evening. The water for irrigation is baled out by the coolies in pots from wells dug out at definite distances within the area. Seedlings are lifted for planting from about second week of October. The material is mostly taken to Guntur and other places for planting. There is very little of planting round about Chirala.

As a rule, the ryots round about follow the same method and routine in the raising of the nursery.

The Pest, Its Incidence and Extent of Damage.

From the figures kindly furnished by Mr. Winders it would appear that the insect occurs in a pest form every year and, since 1930 has been definitely known to be on the increase. Damage to seedlings in the early stages consists chiefly in the removal of mesophyll from underneath, leaving glassy translucent patches above. If the incidence starts early the seedlings are totally denuded of their first formed leaves and there is a consequential severe mortality in the seedlings. The magnitude of the problem can well be imagined when the Company spends during the critical period about Rs. 900 for spraying, and nearly an equal amount in handpicking the caterpillars.

The pest ceases to be a menace when the nursery is about a month old. It follows therefore that the pest requires to be controlled in the earlier stages, when the seedlings are in the 4th leaf stage, if really a good stand of the nursery is to be obtained.

Insect Associations.

It was often noticed that the pest occurred in association with *Plusia signata* F. and *Prodenia litura* F. in the ryots' beds and the latter two always outnumbered the pest. But in the company's nurseries the reverse was always the case.

ALTERNATE HOST PLANTS.

Round about Chirala no other economic crop is raised in October except a few nursery beds of *Eleusine coracana,* which are found sparsely infested with *Laphygma,* but never on the scale seen in the tobacco beds. A sand dune weed *Gisekia pharnaceoides* L. was found invariably infested with the pest even as late as September; this weed was not so evident outside the Company's area, so that one is led to attribute the severity of attack in the Company's nurseries to the presence of this alternate host. There is a record made by Mr. Winders that there was a plague of these caterpillars in July 1936 in all the weeds and bungalow sites. Thus it would appear that this weed is, in all probability, the source of primary infection.

CARRY-OVER OF THE PEST DURING THE OFF-SEASON.

So far there is no evidence to show that the pest has anything like a long cycle pupal stage in the shape of hibernating or aestivating pupae. All the pupae without exception turn into adults after a specified period. There is not even a single record of a pupa surviving for over 15 days out of a rearing of nearly 200 moths in January and February. The weeds in the fallow area must be carrying on the pest till such time as the tobacco seedlings appear.

LIFE HISTORY STUDIES.

The studies detailed hereunder were made at an Insectary under Coimbatore conditions.

Moths.—They are known to lay both fertile and unfertile eggs freely during night and are less active during day time. They begin laying eggs on the 2nd day of emergence. No host preferences shown for laying eggs, a weed or stray plant is sometimes preferred to tobacco leaves.

Eggs.—Eggs are laid in small masses of 20 to 280 each; they are covered lightly with light grey felt of hairs. Each egg is pale green and highly sculptured; it changes colour from pale green to light yellow with a pink central spot at the basal end and finally becomes fuscous at the apical pole. Under captivity the eggs were freely laid on the muslin sides of the leaf and glass jars, but never on the soil. The eggs hatch in 48 to 56 hours.

Larvae.—Hatchlings are buff coloured with the head black; the abdominal segments carry black hairs mounted on warts; growth is extremely slow in the first 5 to 6 days. Full fed and half fed larvae show a wide range of variation in colour. Larvae bred out of a single pair of moths were invariably of the same colour when fed on the same food.

They bite holes into the succulent leaves from underneath. As with cutworms, they have the habit of dropping down and assuming a curved posture. They eat more voraciously at night and are not inclined to migrate far out. In an experiment, out of 45 caterpillars allowed to feed in a marked area of the tobacco nursery bed none were ever found beyond a radius of one foot even after a lapse of 10 days. Larval life lasts for about 15 days.

Pupae.—The mature larvae pupate naked mostly on the surface; a few pupate within the soil at depths of 2 to 4 inches in cocoons made of silk and earth.

Pupal period does not vary much even when the moisture content of the soil is varied. There is always a total emergence of moths and in no case was there delayed emergence. Pupal period lasts for 6 to 7 days.

Sex ratio.—The sex ratio is nearly equal. Of nearly 200 moths reared 110 were females.

Fecundity and longevity of female moths.—A female moth is ordinarily capable of laying 1,310 eggs. The daily output for the first few days ranges near 350 to 300 eggs. There is then a gradual fall. The moths are capable of living for 15 days when fed on sugar syrup.

Life cycle.—A generation is completed in about 24 days.

Parasites and Predators.

Numerous caterpillars were collected separately from the tobacco seedlings and the weed, and kept separate in small receptacles. From the former there were no parasites. But from the latter two tachinid parasites—*Sturmia inconspicuoides* and *Actia monticola*—were obtained. Only five larvae were found parasitized out of a total of 150.

It seems strange that out of a large number of caterpillars collected from tobacco there should be no parasites. The repeated waterings and extra dense vegetation, perhaps, offer little scope for the parasite to play its role effectively and hence their total absence. A Reduvid bug—*Rhinocoris fuscipes*—was found in fairly large numbers. These natural enemies were studied and the following is a summary of the same.

Rhinocoris fuscipes.—This is predaceous on young and old caterpillars. An adult bug can easily finish off four to five caterpillars in a day. As a rule, bugs are less inclined to attack full grown caterpillars, unless forced to for want of suitable stages. In captivity, they take to full grown caterpillars of every kind. Two or three of them sometimes join together and suck the larva dry; it is reduced to an empty skin before it is finally discarded. The following caterpillars and grubs were tried and found acceptable to the bug:—(1) *Spodoptera mauritia* B, (2) *Prodenia litura* F, (3) *Anaphaeis messentina*, (4) *Noorda blitealis* W, and (5) *Hypolixus brachyrrhinus* B.

Adults and nymphs seem to thrive extraordinarily well on *Pereginus maidis*, the cholam shoot bug, on which most of the rearing was done at the Insectary. There was no paucity for the shoot bug so long as there was cholam crop in the field.

Sexes can easily be distinguished. The female is usually more plump and is devoid of any mid-vertical black stripe on the last abdominal segment. The latter character is possessed by the male and serves to distinguish it from the female.

Pre-oviposition period.—This period lasts for about 2-3 days. The female pairs with the male easily and remains in copula for nearly half an hour. Eggs are usually laid in the night on the 5th day of emergence.

Eggs.—Eggs oblong and finger shaped, arranged vertically in batches of 5 to 38. They are olive in colour when fresh but later turn dark chestnut brown. The apical end is provided with a white frill like top which is drawn out into a papery rim. There is a tessellated depressed area in the centre. The outside surface of the egg is finely rugose. Each egg measures 5 mm. long and 2 mm. broad at the top. The eggs hatch normally in 5 to 7 days. Emergence is always total and takes place both in the mornings and afternoons.

Nymphs.—From casual inspection, the first instar nymphs look like small red ants—*Monomorium.* They are orange in colour; on the apical end of the abdomen is a black patch which is very conspicuous. The nymphs have the habit of tilting up the abdomen while moving about. But this habit is lost when food is taken and the abdomen is gorged. For want of young caterpillars, *Aphis gossyphii* G. and *Macrosiphum pisi* were offered but were not accepted. Both adults and nymphs however, feed well on *Peregrinus maidis.* Each nymph is capable of destroying 4 to 8 shoot bugs quite easily. The prey is held up at the point of the proboscis and is dropped only after completely sucked. Slightly advanced nymphs also feed on *Tribolium* and *Myllocerus* beetles. The well-fed nymph has a bloated abdomen and the black patch is rendered very conspicuous.

The nymphs undergo 5 moults before becoming adult. The interval between an instar is roughly 4 to 5 days. In the last instar the nymph is fairly well developed and assumes a ruddy hue in sharp contrast with the dull orange colour of the previous instars. The adult transformation is effected by the nymph of the sixth instar breaking open along the fronto-thoracic region and slowly pushing its head and body out. At the time of transformation, the head and the body are pink and after hardening, develop the bright crimson and shining black colour of the adults.

Fecundity of female bugs.—Each female is capable of laying a maximum of 340 eggs. The daily range of egg-laying varies from 5 to 38. Eggs are laid sometimes on alternate days and sometimes in regular sequence.

Longevity.—Adults, both male and female, are capable of living up to 35 to 90 days.

Total life cycle.—The life cycle is completed in 31 to 51 days.

The following tables give further details regarding life cycle.

LIFE CYCLE RECORD

Serial No.	When eggs were laid	When hatched	Egg period in days	First moult	Second moult	Third moult	Fourth moult	Fifth moult	When adults emerged	Nymphal period in days	Total life cycle in days
1	15–10–36	21–10–36	6						6–12–36	45	51
2	15– 2–37	23– 2–37	8						27– 3–37	34	42
3	15– 2–37	22– 2–37	7	1–3–37	5–3–37	8–3–37	16–3–37	23–3–37	27– 3–37	26	33
4	17– 2–37	24– 2–37	7	3–3–37	5–3–37	8–3–37	13–3–37	20–3–37	24– 3–37	30	33
5	18– 2–37	23– 2–37	5						23– 3–37	30	35
6	19– 2–37	26– 2–37	7	5–3–37	8–3–37	13–3–37	20–3–37	26–3–37	31– 3–37	35	42
7	22– 2–37	1– 3–37	7						31– 3–37	31	38
8	24– 2–37	3– 3–37	7	7–3–37	11–3–37	16–3–37	20–3–37	27–3–37	1– 4–37	30	37
9	28– 2–37	6– 3–37	6						1– 4–37	25	31
10	2– 3–37	9– 3–37	7						4– 4–37	27	34
11	3– 3–37	10– 3–37	7						5– 4–37	25	32
12	27– 2–37	6– 3–37	7	13–3–37	16–3–37	18–3–37	21–3–37	27–3–37	1– 4–37	25	32
13	6– 3–37	13– 3–37	7	18–3–37	24–3–37	30–3–37	5–4–37	9–4–37	12– 4–37	30	37

FECUNDITY RECORD.

Adult No. 1		Adult No. 2		Adult No. 3		Adult No. 4	
Date	Eggs laid	Date	Eggs laid	Date	Eggs laid	Date	Eggs laid
21-12-36	4	15-2-37	21	18-2-37	37	7-4-37	21
23-12-36	22	17-2-37	15	22-2-37	34	8-4-37	11
25-12-36	26	18-2-37	24	25-2-37	16	9-4-37	22
31-12-36	68	19-2-37	24	26-2-37	20	10-4-37	11
1- 1-37		21-2-37	21	28-2-37	26	11-4-37	10
2- 1-37		24-2-37	30	3-3-37	29	12-4-37	18
4- 1-37	36	26-2-37	21	6-3-37	32	13-4-37	—
9- 1-37	23	28-2-37	23	9-3-37	26	14-4-37	19
17- 1-37	13	1-3-37	8	10-3-37	12	15-4-37	10
		2-3-37	9	11-3-37	13	16-4-37	28
Female died on 27-1-37		4-3-37	38			17-4-37	—
		6-3-37	21	Female died on 13 3-37		18-4-37	24
		8-3-37	23			19-4-37	—
		12-3-37	5			20-4-37	—
		15-3-37	21			21-4-37	24
		17-3-37	18			26-4-37	Female escaped
		20-3-37	13				
		21-3-37	5				
		Female died on 26-3-37					
Total ...	192	Total ...	340	Total ...	246	Total ...	199

Tachinid.—The habits of *Sturmia inconspicuoides* were studied somewhat in detail.

The female is smaller than the male. Immediately after emergence the pair go in copula and remain so for a period extending for more than an hour. The fly freely lays eggs thereafter on any caterpillar given to it during day time. When given a caterpillar the fly approaches it but stands aloof at some distance. When the caterpillar rears its head the fly projects her ovipositor from underneath and glues an egg on to it. Or, an egg is glued on the head without any movement from the caterpillar. All this is done in a twinkling. The egg is pale white but later on turns creamy in colour. As a rule, only one egg is laid and that on or near the head. In rearing studies, every caterpillar which received an egg died the next day before the maggot could get a start and hence rearing could not be pursued further. Six caterpillars were given in succession and every one of them received an egg on the head, all in an hour.

Trichogramma minutum.—Though no actual parasitization of eggs was observed in the field *Laphygma* egg masses were given to the parasite to parasitize them. There were six trails under enclosed conditions. The results obtained are tabulated hereunder.

PARASITIZATION RECORD—HOST: LAPHYGMA EGGS.

No.	When parasites introduced	When parasites emerged	No. of eggs in egg mass	No. eggs parasitized	No. of hatchlings found	No. of eggs spoiled
1	13-1-37	23-1-37	142	40	42	58
2	15-1-37	25-1-37	126	40	44	42
3	23-1-37	3-2-37	86	32	24	30
4	24-1-37	4-2-37	78	21	14	41
5	28-1-37	7-2-37	148	36	42	57
6	31-1-37	10-2-37	196	37	81	68

The parasites would appear to regard the felt of hairs as an impediment to a complete parasitization. Eggs on the margins are more easily parasitized than those in the centre.

The utilisation of the parasites and predators in the control of the pest looks far from promising. Firstly, the reproductive potential of the pest is very high when compared with that of the predatory bug or of the parasites in a given length of time; secondly, as the life cycle of the bug is extended over a longer period it cannot be expected to complete sufficient generations to outstrip the pest in numbers; thirdly, the duration of the crop is short. Hence the idea of biological control has to be given up.

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THE GUM ARABIC OF THE BAZAARS AND SHOPS OF BOMBAY.

BY

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The history of gum arabic carries us back to a remote antiquity, for as early as 2,000 years B.C. the Egyptian fleets used to ship that commodity from the gulf of Aden. Mention of the gum is of frequent occurrence in Egyptian inscriptions, and it is now a well-established fact that the drug was used by the natives in the fabrication of colours for painting.

As has been the case with many commodities, gum arabic found its way out of Egypt and reached Greece and Rome, where it was looked upon as a product indigenous to the region of the Upper Nile.

Since the first century of the Christian era the soluble gum procured in the Sudan has been an article of commerce shipped to Arabian ports and thence to Europe. And as the gums were chiefly called after their place of origin, or the port from which they were exported, the drug received the name of *gum arabic*. During the Middle Ages the trade was largely carried on through Turkish ports or ports under Turkish rule, and the gum was then given the name of 'Turkey gum', a name that is still frequently used in the trade.

The so-called 'East Indian gum' was for some time responsible for a considerable trade. It was chiefly a re-export trade, the supply being drawn from Arabia and Africa and first imported into Bombay from the Red Sea ports; it was then exported from Bombay to England, to the continent of Europe, and to America. 'Indian' or 'East Indian' gum, then, is not gum of Indian origin, and it is doubtful if any gum produced in India ever found its way to Europe as an article of commerce.

Gum arabic also reaches Europe from Western Africa, with which region the Portuguese had a direct trade as early as 1449. Owing to the troubles in the Sudan the French turned to their own colonies for supplies of gum arabic, and their trade from French Senegal was ultimately started.

The more common varieties of gum arabic that now reach the market are: Gum Senegal, Kordofan or Turkey gum, Suakim gum, Barbary or Morocco or Mogador gum, East India gum, Cape gum, and Australian or wattle gum.

The name 'gum arabic' embraces gums from several botanical sources; but most varieties are obtained from various species of the genus *Acacia* belonging to the sub-order *Mimoseae* of the order *Leguminosae*. There are in all 430 species of *Acacia* in the tropical and subtropical regions, chiefly of Africa and Australia. India possesses some 22 species, and the Sudan about the same number.

Owing to the vagaries of botanical synonymy the list of gum-yielding Acacia trees as mentioned in various books is as long as it is unsatisfactory. A critical examination has led us to retain the following species as forming a fairly complete and an up-to-date list of the plants which are known to yield gum arabic:—*Acacia abyssinica* Hochst., *A. albida* Delile, *A. arabica* Willd., *A. ataxacantha* DC.,[1] *A. binervata* DC., *A. caffra* Willd., *A. Catechu* Willd., *A. cochlearis* Wendl., *A. decurrens* Willd., *A. detinens* Burch., *A. Dudgeoni* Craib, *A. eburnea* Willd., *A. Ehrenbergiana* Hayne, *A. erubescens* Welw., *A. etbaica* Schwf., *A. Farnesiana* Willd., *A. ferruginea* DC., *A. giraffae* Willd., *A. glaucophylla* Steud., *A. homalophylla* A. Cunn., *A. horrida* Willd., *A. Jacquemontii* Benth., *A. Kirkii* Oliver, *A. Krausiana* Meissn., *A. laeta* R. Br., *A. latronum* Willd., *A. lenticularis* Buch.-Ham., *A. leucophloea* Willd., *A. macrostachya* Reichb., *A. mellifera* Benth., *A. microbotrya* Benth., *A. modesta* Wall., *A. pendula* A. Cunn., *A. penninervis* Sieb., *A. planifrons* Wight and Arn., *A. pycnantha* Benth., *A. Rehmanniana* Schinz, *A. robusta* Burch., *A. Senegal* Willd., *A. Seyal* Delile, *A. Sieberiana* DC., *A. spirocarpa* Hochst., *A. stricta* Willd., *A. Stuhlmannii* Taub., *A. Suma* Kurtz, *A. tortilis* Hayne, *Albizzia Lebbek* Benth., and *A. stipulata* Boiv.

All pharmacopoeias recognize various species of the genus *Acacia* as an official source of 'gum arabic' or, as it is now better known, 'gum acacia'. They all admit *A. Senegal* Willd. as the principal source of the drug. In addition to this species the French Pharmacopoeia refers to *A. arabica* Willd., and the Spanish Pharmacopoeia to *A. arabica* Willd., *A. Seyal* Delile, and *A. tortilis* Hayne. *A. Verek* Guill. and Perr. of the Pharmacopoeia for Russia is synonymous with *A. Senegal* Willd. Austria, Brazil, Finland, Germany, Hungary, Italy, Japan, Mexico, Norway, Portugal, Spain, Turkey and the United States of America restrict official recognition to the African species.

Numerous tests have been proposed for determining the identity and the purity of gum arabic, but too much reliance ought not to be placed on them; not only gums from different trees, but also gum from the same tree, often exhibit different characters or give different results with the same reagents. Thus, for instance, different varieties of gum arabic yield aqueous solutions of characteristically different types; some produce a thin syrupy solution, others a thick jelly-like one. The percentage of ash and the percentage of moisture depend upon the particular gum under experimentation, and for the same gum on the climatic conditions. The extent to which climatic and geographic conditions may affect plants and their exudation products may be gauged from the behaviour of *Acacia decurrens* Willd. In its native Australian habitat it produces a sparingly soluble gum; if transplanted to Java and grown there it yields a perfectly soluble gum.

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[1] According to J. M. Dalziel (*The useful plants of West Tropical Africa*; March 1937; p. 205) 'the tree is not a gum-yielder'.

Nevertheless, we found the tests mentioned in the various pharmacopoeias sufficient for our purpose, which was to ascertain whether the gums sold in the bazaars of Bombay as gum arabic may be taken to represent that commodity and whether they may safely be used for edible and medicinal purposes.

In pharmacy, gum arabic is extensively used as a demulcent and a suspending agent in making emulsions and mixtures, pills and troches. The mucilage of acacia, and the syrup are used to suspend insoluble, and to disguise the taste of unpleasant, drugs.

Gum arabic is employed to relieve topical irritation and as a protective in cases of superficial excoriation, ulcers, burns, sore nipples, etc. The powdered gum is used in checking haemorrhage from leech bites, and when blown up the nostrils arrests severe nosebleed.

The gum is advantageously employed in catarrhal affections and irritation of the fauces, by being held in the mouth and allowed to dissolve slowly. In Transvaal a plaster made from capsicum fruit, Cape gum, and strong vinegar, is applied in acute inflammation of the bone marrow, and a mucilage of Cape gum to the mouth in thrush and sprue.

The Egyptians used gum largely in painting. An inscription exists, which states that in a particular instance a solution of 'kami' (gum) was used to render adherent the mineral pigment 'chesteb', the name applied to lapis lazuli or to a glass coloured blue by cobalt.

Large quantities of gum arabic are used for giving lustre to crape and silk, and for thickening colours and mordants in calico printing; in sizing cloth and paper; for suspending tannate of iron in the manufacture of ink and blacking; in preparing certain pigments, varnishes, paints and colours.

GUM ARABIC IN INDIA.

The various forms of gum arabic found in the Indian market may be distributed into three groups:—1. *True gum arabic of European commerce*, 2. *East Indian gum arabic*, 3. *Indian gum arabic*.

1. The bulk of the *true gum arabic* used in India finds its way into this country directly from Africa; but the finer pure grades are bought from leading firms in London and in Germany.

2. *East Indian Gum* is entirely imported from Aden and the Red Sea ports—no part of it being produced in India. It is hand-picked and assorted in Bombay, and then re-exported to Europe and America.

3. *Indian gum arabic* is the name given to the commodity of Indian origin. This consists of a multitude of diverse gums hopelessly intermixed, but representing the produce of the land. Rarely clean and always mixed, gum of Indian origin does not find its way to Europe or America, unless it be as an adulterant of East Indian gum. The gum is, however, an important article of internal trade, and has a particular claim on our attention as it is the form more commonly found in the bazaars of Bombay.

Nowhere in India is gum systematically produced, nowhere has a large uniform and constant supply been organised. Let alone indifference and apathy, the reason of this state of affairs is mainly due to the peculiar distribution of the gum-yielding trees. These are to be found in very large numbers throughout the length and breadth of India, they belong to several different natural orders and often represent various species of the same genus, but there is not one of them which anywhere exclusively covers a wide area. And as the collectors—usually women and children—gather indiscriminately whatever looks like gum, the article which finally reaches the shops of the larger dealers is a mixture which defies description.

The following are the better known gum-bearing trees of India:—

RUTACEÆ: *Feronia Elephantum* Corr.

MELIACEÆ: *Azadirachta indica* A. Juss., *Cedrela Toona* Roxb., *Chloroxylon Swietenia* DC., *Swietenia Mahagoni* Jacq.

ANACARDIACEÆ: *Anacardium occidentale* Linn., *Lannea grandis* Engl., *Mangifera indica* Linn., *Spondias pinnata* Kurz.

PAPILIONACEÆ: *Delonix regia* Raf.

CAESALPINIACEÆ: *Bauhinia purpurea* Linn., *B. variegata* Linn.

MIMOSACEÆ: *Acacia arabica* Willd., *A. catechu* Willd., *A. decurrens* Willd., *A. Farnesiana* Willd., *A. ferruginea* DC., *A. Jacquemontii* Benth., *A. lenticularis* Buch.-Ham., *A. leucophloea* Willd., *A. modesta* Wall., *A. pycnantha* Benth., *A. Senegal* Willd., *A. Suma* Kurz, *A. Sundra* DC., *Albizzia Lebbeck* Benth., *A. odoratissima* Benth., *A. procera* Benth., *A. stipulata* Boivin, *Pithecellobium dulce* Benth., *P. Saman* Benth., *Prosopis spicigera* Linn.

COMBRETACEÆ: *Anogeissus latifolia* Wall., *Terminalia belerica* Roxb.

EUPHORBIACEÆ: *Aleurites moluccana* Willd.

Indian gum arabic finds its use in pharmacy as a substitute for the true gum arabic, as an emollient and demulcent.

It is used medicinally by the Mahommedans who consider it to be pectoral, strengthening and restorative. It has been employed with alleged benefit in intermittent fevers and scurvy. Topically it is used with advantage in ulceration and sponginess of the gingiva, relaxation of the uvula, and hypertrophy of the tonsils.

In times of scarcity it constitutes an important article of food, and at all times a much esteemed delicacy. The gum is fried in ghee, mixed with spices, and made into a sweetmeat; it is eaten by all, but specially administered to women in childbed.

A considerable amount of Indian gum is used in calico printing, and in the match and paper industries.

GUM ARABIC IN BOMBAY.

A survey of the local trade in gum arabic was undertaken with a view to ascertain the source or sources of this commodity and the uses it is more commonly put to. In our opinion the information gathered would help not only in determining more readily the nature of the material collected but also, and chiefly, in passing a fair judgment on its value. It stands to reason that a gum intended for culinary or medicinal purposes is not to be judged from the same standards as a gum which is meant to be exclusively used as an adhesive. What would amount to gross adulteration in the first case would not do so in the second.

We have visited shops, about a hundred of them, of all descriptions. From the information supplied it appears that there are three chief types of gum arabic placed for sale in the Bombay market: 1. *the true gum arabic of Sudan*, 2. *East Indian gum*, and 3. *Indian gum*. And there are three main sources wherefrom those gums may be obtained: 1. *the Chemists and Druggists*, 2. *the wholesale merchants*, and 3. *the retail dealers*.

A. *Chemists and Druggists* get their samples directly from gum-exporting countries such as Egypt and Sudan, or from England and Germany. They generally stock three varieties, the prices depending on the quality and the colour: a. *gum acacia elect,* b. *gum acacia ordinary*, and c. *pulverised gum acacia.* They are all intended for medicinal and pharmaceutical purposes.

Some of the firms admitted using Indian gums in the preparation of their pharmaceuticals; a fact which was confirmed by the detection of the products of *Acacia Catechu, Anogeissus latifolia,* and *Azadirachta indica.*

Anyhow the gum sold by the Chemists and Druggists of Bombay as 'gum arabic' or 'gum acacia' was found to conform to all the tests required for the pharmacopoeial article 'Acacia'.

B. *Wholesale Merchants* :—The wholesale dealers in gums reside in that part of Bombay known to the general public as 'Danabunder', an unmapped locality situated within the Mandvi area. There the trade is quietly but efficiently carried by Gujeratis, Jain Banias, Kutchis, and a few Mahommedans; all of them remarkable for the courtesy of their manners and their readiness to oblige. There too, in Samuel Street, is the seat of the 'Bombay Gum Merchants' Association'.

The Association was founded with the object of promoting feelings of goodwill among the gum merchants, and of encouraging the trade by looking after the general interests of the dealers. 'The Association will strive to settle disputes and debatable points, and will hold correspondence with the authorities and other public bodies and institutions with the object of promoting the general good of the merchants. It will also discuss matters relating to the general good of the country and, when occasion demands, will raise and manage funds in this connection.'

Not all the gum merchants, however, are members of the Association; a fact of great significance since the members, though allowed to import or export gums, are not permitted to trade in 'katcha' gums, that is the unsorted raw material. Members of the Bombay Gum Merchants' Association may only trade in 'pakka' gums, that is graded gums obtained after the cleaning and sorting of the raw material.

No restriction of any kind is put on the trade of the non-members who deal indifferently with the so-called 'katcha' and 'pakka' materials. They receive the raw products from various parts of India, hold a sort of private auction sale at their own godowns or shops, and dispose of the stuff to the members through brokers.

On reaching the godown the large dirty masses of 'katcha' material are first broken and cleaned by men. The broken stuff is then passed on to women, especially noted for their patience and industry, whose duty it is to sort the pieces according to size and colour. The finished product is labelled, its price fixed, and then —and only then—is the merchant, member of the Association, allowed to put the gum on the market for sale.

The gums stocked by the wholesale merchants at Danabunder may be grouped according to the place they come from as 1. *gums from the Sudan*, 2. *gums from Iran and Iraq*, and 3. *gums from India*.

1. The gums that reach Bombay from the African ports are 'gum arabic' and 'gum talha'. After their arrival they are sorted and cleaned, and made into grades according to the size and colour of the fragments.

The very small particles are set aside to be pulverized and sold as powdered acacia gum. The colourless big lumps and the colourless small fragments, which look very clean and pure, are sold under the names of *maklai* (so named after the port of Makalla) or *safed gundar*. They are divided into two grades, *maklai no.* 1 and *maklai no.* 2, according to the colour. There is, moreover, a third variety, considered inferior to these, sold as *maswai* (from the port of Massawa) or *lal gundar*. In one of the shops maklai no. 1 sold at Rs. 38 per cwt., maklai no. 2 at Rs. 30 per cwt., and maswai at Rs. 26 per cwt.

These gums have a very good sale and are in great demand in the city as well as outside. They are used as an article of food, in the manufacture of confectionery, and also as an adhesive. They were found to be *gum acacia*, occasionally mixed with the gum of *Azadirachta indica*.

2. *Gum shiraz* and *gum mamrah* are two insoluble gums imported from Iraq and Iran. They are exhibited in various grades which are used locally for medicine, confectionery, dyeing and printing. Large quantities are exported to America and other continents.

They were identified as the products of *Albizzia Lebbeck* and *A. odoratissima*.

Gum mamrah of Indian origin was found to consist of a mixture of gums from *Acacia arabica* and *A. modesta*.

3. Gums reach Bombay from all parts of India; more particularly from Cawnpore, the Central Provinces—Jubbulpore, Nagpur, Amraoti—, Rajputana, Punjab, Sind, Cutch, Kathiawar, East and West Khandesh, Gujerat, and the Western Ghats.

Gum *bavool* is mostly used in printing and dyeing, and is bought chiefly by millowners and dyers. It sells at Rs. 32 per cwt.

Gum *ghati* is sold under two forms: (1) a superior kind which is eaten by the people, and (2) an inferior kind which is powdered and used as an adhesive in whitewashing. Its price is Rs. 31 per cwt. The residue left over after the removal of the better grades is sold at Rs. 10 per cwt.; it most probably finds its way to some obscure bazaar shop where it is again sifted so as to enable the keeper to make a little profit out of it.

The term 'ghati' is very confusing. Some dealers apply it to any mixture of gums, while others restrict it to gums imported from the Western Ghats, and others maintain that true 'ghati' is the exudation product of *Acacia Catechu*.

Gum *khota* is an insoluble gum, used for edible purposes, which fetches Rs. 20 per cwt. The sample we analysed was a mixture of gums from *Albizzia odoratissima, A. stipulata*, and *Cedrela Toona*.

Gum *karaya* is mostly used locally for medicinal and culinary purposes, and occasionally in printing and dyeing. It is listed at Rs. 40 per cwt. This is never sold as 'gum arabic', and is therefore outside the scope of this paper. It is exported in very large quantities to Germany and other foreign countries, more particularly the United States of America.

C. *Retail Dealers*:—Most of the local dealers, generally grocers, buy their stock according to need from the wholesale merchants at Danabunder. A few deal directly with firms in Gujerat, Kathiawar, Cawnpore, East Khandesh and Thana Districts; or with collectors in villages of the Deccan and the Western Ghats. Others again procure their goods from the Gonds, Bhils, Katkaris or other hillmen, who visit the city occasionally and whose occupation is to collect gums from the trees of the forests.

True to the tradition of Indian lore, one or two Hindu shopkeepers told us that their samples were from the Himalayas and had been collected there by Rishis and Yogis; and the said samples were accordingly possessed of miraculous curing properties, whether administered internally or externally in any form whatsoever. No less emphatic the pair of Mohammedans who had their stuff brought from holy places in Iran, Iraq, and Arabia!

But, as a rule, the men behind the counter give the goods for what they are. They all readily admit that no article is the genuine 'gum bavul' or 'acacia gum'; but a mixture of this with such other gums as kher, bel, ber, lemon, neem, gonda, etc. Nevertheless, the bavul gond, owing to its colour and size and the presence of numerous fissures, is always recognizable and, should necessity arise, could be picked out from the mixture and supplied to the customer.

For the only thing that matters here is to please the customer and meet his requirements. The uses to which the gum is put are, indeed, so very numerous and varied, that the merchant has to keep a large number of assorted grades to be able to satisfy the needs of his clientèle. Hence the equally long list of vocables under which the commodity is sold ! *gundar, babool, dink, katila, ghati, makali, dhavda, dhavdi* or *dhavli, kadala* or *karaya, kani babool, deshi babool, bambul, arabi gond, safed gundar, kher, lal gundar, gorad gond,* etc.

The gum is used by mill-owners in the finishing of cloth and paper. It is also employed in the match industry, and in the preparation of water colours, inks, varnishes and paints, and in calico printing. Mixed with lime, mortar and cement it finds its way into house-building operations.

As an adhesive, gum arabic is used in the preparation of wigs, paper kites, clay toys; and there is a very heavy demand for it at the time of the Ganpat festival. A fairly large amount is also needed for the manufacture of the various cosmetics more abundantly required on festive occasions.

Gum bavool is frequently used for adulterating asafoetida—*hing;* by soaking hing in a thick paste of gum and drying, or by soaking gum-crystals in a concentrated hing solution and drying, and selling as asafoetida.

The gum is in great demand and sells very well in the localities inhabited mostly by Hindus : Gujeratis, Kathiawaris, Deccanis. It is used in the preparation of *laddu* and numerous other kinds of sweetmeats, of peppermints, sherbets, and syrups; and it is often chewed after meals.

Bavool is an indispensable article in the armamentarium of vaids, kavirajs and hakims, who credit it with numerous curative properties.

Even the inferior, coloured varieties find a ready sale. They are mixed with water and given to cows to increase their output of milk.

MATERIAL COLLECTED.

In all we have collected and examined 153 samples, and we have every reason to believe that our work is exhaustive. The tests for identification and purity rest almost entirely on the solubility of the gum in water, and the behaviour of the aqueous solution to such reagents as lead acetate, lead subacetate, ferric chloride, and borax.

We have prepared and used the following key for the identification of the various gums in hand:—

1	Gum entirely soluble in water	2
	Gum partially soluble or insoluble in water ...	16
2	No turbidity	3
	Turbid mucilage from insoluble suspended substances	12
3	Precipitated by neutral lead acetate ...	4
	Not affected by neutral lead acetate ...	7
4	Not affected by borax	5
	Gelatinized by borax	*Prosopis spicigera.*

5	Gelatinized by basic lead acetate	6
	Precipitated by basic lead acetate	*Feronia Elephantum.*
6	A good pale-coloured mucilage with water	*Acacia modesta.*
	A weak dark-coloured mucilage with water	*Swietenia Mahagoni.*
7	Gelatinized by ferric chloride	8
	Not gelatinized by ferric chloride	10
8	Gelatinized by borax	9
	Unaffected by borax	*Azadirachta indica.*
9	Thick brown mucilage with water	*Pithecellobium dulce.*
	Thick pale-coloured mucilage with water	*Acacia Catechu.*
10	Gelatinized or precipitated by basic lead acetate	11
	Unaffected by basic lead acetate	*Acacia arabica.*
11	Gelatinized by basic lead acetate	*Anogeissus latifolia.*
	Precipitated by basic lead acetate	*Acacia* sp.
12	Not affected by neutral lead acetate	13
	Precipitated by neutral lead acetate	*Bauhinia variegata.*
13	Gelatinized by ferric chloride	14
	Not gelatinized by ferric chloride	15
14	Turbidity due to suspended yellowish oil	*Lannea grandis.*
	Presence of calcium oxalate in sphaero-crystals	*Delonix regia.*
15	Gelatinized by borax	*Acacia arabica.*
	Unaffected by borax	*Anacardium occidentale.*
16	Gum incompletely soluble, forming a gelatinous mucilage with a large volume of water	17
	Gum swelling up into a gelatinous mass, very little dissolving	22
17	Precipitated by neutral lead acetate	18
	Not precipitated by neutral lead acetate	19
18	Gelatinized by borax	*Acacia Farnesiana.*
	Unaffected by borax	*Spondias pinnata.*
19	Unaffected by neutral lead acetate	20
	Gelatinized by neutral lead acetate	21
20	Gelatinized by ferric chloride	*Albizzia Lebbeck.*
	Unaffected by ferric chloride	*Cedrela Toona.*
21	Gelatinized by borax	*Aleurites moluccana.*
	Unaffected by borax	*Albizzia procera.*
22	Swells to a gelatinous, jelly-like mass	23
	Swells to tough cartilage-like masses	25
23	A tough gelatinous mass	24
	A whitish transparent jelly; mucilage turbid, dark mahogany-red; smell of fusel oil	*Chloroxylon Swietenia.*
24	Gum dark brown, smooth, free from cracks; crystals of calcium oxalate	*Terminalia belerica.*
	No crystals of calcium oxalate	*Bauhinia purpurea.*
25	Gum soft and tough; with waved transverse ridges	*Pithecellobium Saman.*
	Gum from amber to dark-brown; superficially fissured, free from cracks internally	*Albizzia odoratissima.*
	Gum tough and dark, swelling up to cartilage-like masses in water	*Albizzia stipulata.*

In every case the result was checked and confirmed by reference to the specific characters of authentic samples.

77 articles were found to consist of only one constituent: *Acacia arabica* (40), *A. Catechu* (1), *A. modesta* (3), *Acacia* sp. (11), *Anogeissus latifolia* (1), *Albizzia Lebbeck* (1), *A. odoratissima* (1), *Azadirachta indica* (8), *Cedrela Toona* (3), *Chloroxylon Swietenia* (1), *Pithecellobium Saman* (3), *Swietenia Mahagoni* (1), *Astragalus* sp. (3).

51 specimens were mixtures of two constituents : *Acacia arabica* + *A. modesta* (8), *Acacia arabica* + *Anogeissus latifolia* (3), *Acacia arabica* + *Albizzia odoratissima* (1), *Acacia arabica* + *Azadirachta indica* (6), *Acacia arabica* + *Bauhinia purpurea* (1), *Acacia arabica* + *Chloroxylon Swietenia* (1), *Acacia Catechu* + *Azadirachta indica* (1), *Acacia* sp. + *A. arabica* (8), *Acacia* sp. + *A. modesta* (2), *Acacia* sp. + *Anogeissus latifolia* (5), *Acacia* sp. + *Azadirachta indica* (3), *Acacia* sp. + *Feronia Elephantum* (1), *Albizzia odoratissima* + *A. stipulata* (5), *Albizzia odoratissima* + *Bauhinia purpurea* (4), *Albizzia odoratissima* + *Pithecellobium Saman* (1), *Albizzia Lebbeck* + *Cedrela Toona* (1).

21 samples contained three constituents: *Acacia* sp. + *A. arabica* + *A. modesta* (2), *Acacia* sp. + *A. arabica* + *Anogeissus latifolia* (4), *Acacia* sp. + *A. arabica* + *Azadirachta indica* (4), *Acacia* sp. + *A. arabica* + *Bauhinia purpurea* (2), *Acacia* sp. + *A. arabica* + *Bauhinia variegata* (1), *Acacia* sp. + *Albizzia odoratissima* + *Pithecellobium Saman* (1), *Acacia arabica* + *A. modesta* + *Azadirachta indica* (1), *Acacia arabica* + *A. modesta* + *Chloroxylon Swietenia* (1), *Acacia arabica* + *A. modesta* + *Feronia Elephantum* (1), *Acacia arabica* + *Albizzia odoratissima* + *A. stipulata* (1), *Acacia arabica* + *Azadirachta indica* + *Feronia Elephantum* (1), *Albizzia odoratissima* + *A. stipulata* + *Bauhinia purpurea* (1), *Albizzia odoratissima* + *A. stipulata* + *Cedrela Toona* (1).

4 samples were made up of four constituents: *Acacia* sp. + *A. arabica* + *A. modesta* + *Pithecellobium Saman* (1), *Acacia* sp. + *A. Catechu* + *Albizzia odoratissima* + *A. stipulata* (1), *Acacia arabica* + *Albizzia odoratissima* + *Bauhinia purpurea* + *Chloroxylon Swietenia* (1), *Albizzia Lebbeck* + *A. odoratissima* + *Bauhinia purpurea* + *Spondias pinnata* (1).

GENERAL SUMMARY AND CONCLUSIONS.

1. The gum arabic sold in the shops and bazaars of Bombay is of either African or Indian origin.

2. The Sudan gum is either imported directly from Africa or bought from reliable firms in England or Germany. It is invariably pure, and conforms to pharmacopoeical requirements.

3. The Indian product is one of the numerous ingredients found in the 'katcha' gum of Indian home trade. This article, which reaches the wholesale merchants in Bombay from various parts of India, is a very dirty mixture of many kinds of gums gathered indiscriminately. In Bombay the material is first broken up and cleaned, and then sorted into several grades of 'pakka' gum; these

are labelled, their respective prices are fixed, and they are ready for sale to the retail dealers.

4. As the retail dealers in Bombay obtain their goods from wholesale merchants who mostly belong to the 'Bombay Gum Merchants' Association', and as the Association is concerned for the good name of its members, it follows that the better grades of gum are of excellent quality.

5. The Indian gums sold in the bazaars of Bombay may be roughly distributed into two groups according to the vernacular names under which they are sold: (*a*) *bavul, gundar, dink, kher*—; (*b*) *maklai, ghati, katira, deshi bavul,* etc.

6. The 'bavul' or gum arabic group consists of 95 per cent of *Acacia* gums—*A. arabica, A. Catechu, A. modesta,* and several other species. The other gums present in the group are those of *Anogeissus latifolia, Azadirachta indica, Feronia Elephantum*, which have properties similar to those of Acacia-gums, and are acknowledged as good substitutes for gum arabic. The rest are a negligible quantity.

7. In the 'maklai' or 'ghati' group Acacia-gums are found to the extent of 40 per cent, mixed with other gums very different in their properties from gum arabic.

8. Owing to the large number of grades the buyer may easily get the article he needs, and there is no incentive for the merchant to adulterate the goods.

9. The conclusion forced upon us is that the gum arabic of the shops and bazaars of Bombay is the genuine article, and answers the purpose for which it is sold.

THE GAME FISHES OF INDIA.[1]

BY

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(*With one coloured plate, one black and white plate and two text-figures*).

(*Continued from page 71 of Vol.* xli).

VIII.—THE MAHSEERS OR THE LARGE-SCALED BARBELS OF INDIA.

1. THE PUTITOR MAHSEER, *Barbus* (*Tor*) *putitora* (Hamilton).

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INTRODUCTION.

In my prefatory note (**7**)[2] to the present series of articles on 'The Game Fishes of India' it was stated that the taxonomy of Indian fishes, especially of the freshwater species, was in a state of great confusion, and attention was directed to the fact that even in the case of the most valuable game-fish Mahseer the precise generic and specific limits of the forms included under this composite term were not easy to elucidate. The preceding seven articles have made it abundantly clear what an amount of spade work is needed to assign proper scientific names to our commonest food fishes. In dealing with the Mahseers this difficulty is greatly accentuated, because characters, such as scale-counts, fin-rays, colouration, etc., usually employed in distinguishing various species of the Carp tribe have proved of little use in separating the large-scaled Barbels of India into species, subspecies or varieties. The

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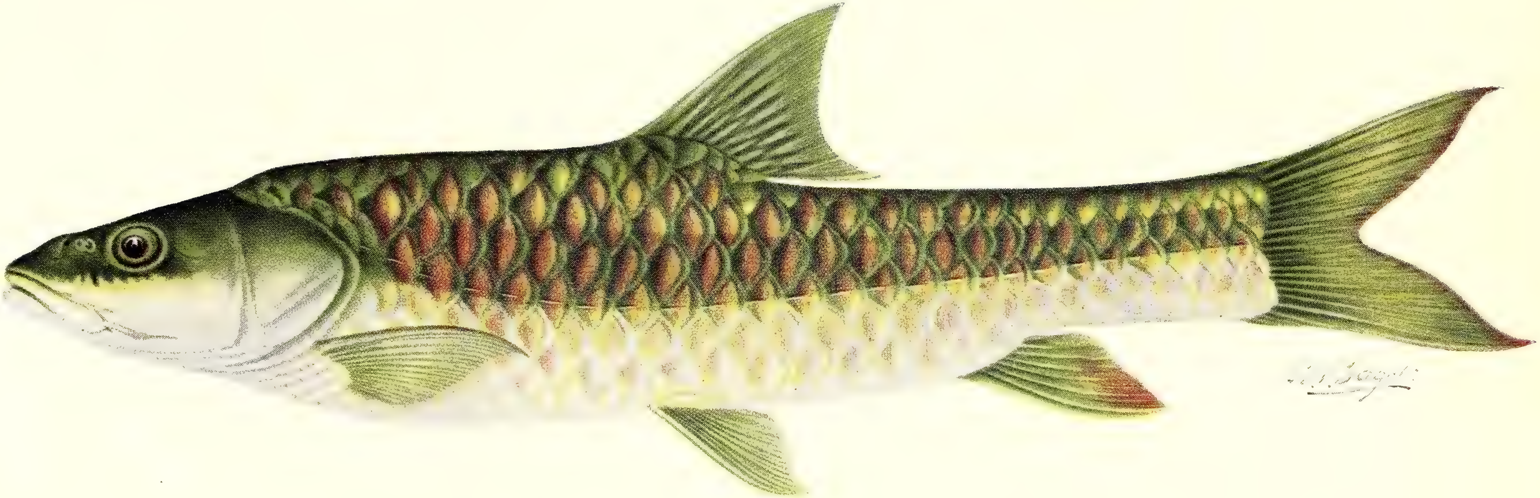
[1] Published with permission of Director, Zoological Survey of India.

[2] Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.



THE PUTITOR MAHSEER.

Barbus (Tor) putitora (Hamilton).

following observations of Thomas (**13**, pp. 27, 28) regarding the varieties of Mahseer are of special interest in this connection:

> 'Further experience has confirmed me in the view advanced in 1873, that there are more Mahseers than have been named, and that if it were possible that as much accurate attention could be given to the Mahseer as has been devoted to the Salmonidae of Great Britain, of Europe, and of America, it would be found that the Mahseers of India would likewise grow in numbers. No one who has not tried it can form any idea of the amount of labour required to collect specimens sufficient to clear up a moot point, to decide which differences are only accidents of local colouring, which the ordinary result of the change of season, which indicate only varieties, and which serve to constitute separate species. To satisfy an accurate mind specimens must be collected from many rivers, in many localities, at various ages, in various seasons, and in goodly numbers; and all details of capture must be reliably noted at the time; all these facts which form the basis of conclusions should also be retained for the satisfaction of other enquirers.'

After making fairly extensive collections, Thomas advanced the view 'that there are at least three distinct forms with difference of external structure, and many more with differences in colouring'. Not being an angler, I am in a less fortunate position to make field observations on Mahseers, but from the preserved material and literature at my disposal at the Indian Museum I shall attempt to define in a chronological order the precise specific limits of the various types of Mahseers described from different parts of India and Burma. At present it is not possible to determine the relations of one with the other; but this will be taken up after the treatment of the various varieties is completed. It will also not be possible to give in the first instance an accurate account of the geographical distribution of each species. The readers are requested to send material of and observations on the bionomics of Mahseers to the Bombay Natural History Society so that in course of time the information can be codified and presented in a suitable form to the angling world.

So much has been written on the methods of fishing for Mahseer that it seems hardly necessary for me to discuss the matter in this series, but in the last article on the Mahseers of India a resumé of what is known along with a general account of the bionomics of these fishes will be given.

ETYMOLOGY OF MAHSEER AND LIST OF VERNACULAR NAMES.

Thomas (**13**, p. 34) noted that

> 'The name Mahseer is perhaps derived from the Hindustani words *maha* great and *sir* (pronounced *seer*) head, or perhaps, as a friend writes me from Delhi, on the authority of a native gentleman there who has been a great angler and is a well-known Persian scholar, from the two Persian words *mahi* a fish and *sher* a lion, in recognition of its gameness.'

According to Dhu (4, p. 5), Mahseer is derived from *Matsya*, 'the Sanskrit word for fish used in the Vedas, and as the Mahseer is undoubtedly the sacred fish of India, it is more than likely that Mahseer is simply a corruption of Matsya. Maha Sir big head, is an alternative derivation.' Lacy and Cretin (**11**, p. 2) discuss the etymology of Mahseer in greater detail and remark

> 'The derivation of Mahseer from maha sir—big head—may be merely an attempt to give a meaning to the word. The derivation from maha sher—big tiger—is fanciful, although the natives sometimes pronounce the word Mahsher; it is merely the soft equivalent of the word. A third and a good derivation is from Mahasaula, Mahasalka—big scaled. The natives often call the fish Mahsol. The Mahseer has got bigger scales than any other fresh-water fish in India. Its big scales form one of its best distinctive characters. A big Mahseer has got scales as big a the palm of one's hand which make the use of the gaff unsafe. The scales are used as playing cards in some parts of India. A fourth, and a likely, derivation is from *Matsya*, which is the Sanskrit word for 'fish', and is used in the Vedas. As the Mahseer is a sacred fish, preserved near many Hindu temples, it is probable that the Brahmans called it 'Fish' par excellence, pronouncing the word Mahsia.'

In the Dak Edition of the *Statesman* of Calcutta, dated the 27th June, 1939, KIM on the authority of Mr. Mohsin Hosain Rizwi contributed a note on the etymology of Mahseer. It is stated therein that the word Mahseer has no phonetic or etymological resemblance to the Sanskrit word 'matsya', and as Mahseer is not a particularly bigheaded fish, therefore, the name cannot be derived from 'maha sir'—big head. The derivation which strikes Mr. Rizwi as more probable, simpler and more logical is that the word 'mahseer' is the corruption of the Persian word 'Mahisher' —*mahi* meaning fish and *sher* a tiger, the reference being made to the tigerish and sporting character of this great game fish.

KIM in agreeing with Mr. Rizwi's observations remarked that in his opinion the 'sir' of Mahseer had nothing to do with the head. 'The "sir" referring to the head is pronounced quite differently from the second syllable of mahseer. The "sir" meaning the head is pronounced like the sir in sirrah, whereas the second syllable of the word for fish is pronounced as it is spelt, "seer", like the word for a sage or prophet.'

Finding so much confusion about the etymology of Mahseer I referred KIM's observations to my cousin, Dr. B. Ch. Chhabra, Assistant Superintendent for Epigraphy in India, and he very kindly sent me the following opinion:—

> 'As regards the discussion about the name *Mahseer*, let me at once say that Mr. Rizwi's Persian derivation of it from *mahisher* is fanciful and far fetched. In the first instance the compound ought to have been *shermahi* in the sense he takes it. Moreover, Kim's objection applies to this *sher* as well as it does to *sir*. Let me in passing also point out that the so-called Persian word *mahi* for fish is a corrupt form of the Sanskrit *matsyī* 'female fish' though it looks so strange.'

Dr. Chhabra then gives details of the process by which the Persian *mahi* is derived from the Sanskrit *matsyī,* giving numerous instances in support of his arguments. He thinks that the term Mahseer 'is derived from *mahāśīras*, the reference to greatness or bigness may be to the front part of the fish and not only to its head or snout'. This derivation is supported by Yule and Crooke (**15**, p. 538) in *Hobson Jobson.* To meet KIM's objection that the vowel in *seer* of Mahseer is not like in 'sirrah' but is like that in 'seer', Dr. Chhabra suggests the derivation to be from *mahāśīrsha* without altering the sense. The dropping of the final *sha* in a corrupt word is not impossible, *śiras* or *śīrsha* mean the same thing.

I have also consulted Mr. T. N. Ramachandran, Superintendent, Archaeological Section, Indian Museum, and he agrees that Mahseer is very likely a colloquial form of *Mahāśīrsha* or *Mahāśiras*.[1]

There are several local names under which Mahseers are known in different parts of India. In recording *Cyprinus putitora* from the Rangpur District, Hamilton (*vide* Day **3**, p. 50) noted that

> 'The *Mahāsaul* of the polished dialect of Bengal, called Putitor in the vulgar dialect of Goalpara, is the largest of the carp kind that we have, and is often found nine feet in length, and six feet is an usual size. The scales are exceedingly large, being like the hand, and at Dacca are often made into cards with which people game. It is reckoned coarse food.'

There is hardly any doubt that in *Mahāsaul* reference is made to the large scales of the fish and that the term is derived from the Sanskrit *mahāśalkalin*, meaning a fish with large scales.

The following are some of the vernacular names under which Mahseers are known in different parts of India and Ceylon :—

Putitor (Goalpara); *Tor* (Rangpur); *Săhărá* and *Tŭrĭyá* (Purneah); *Mŭsā́l* (Kosi R.); *Kajrā́* (Dáū́dnagar, Sone R.); *Burapatra, Junga Peetia* (Assam); *Naharm* (Hindi); *Kukhiah* (Punjab); *Kurreah* (Sind); *Kendi, Bŏm-mín* (Tamil); *Peruval, Harale-mìnu* (Canarese); *Hăllămìnu* (Mysore Canarese); *Meruval* (Malayalam); *Heragălu, Peruval* (Tulu); *Kadchi, Masta* (Marathi); *Kuriah, Lela* (Ceylonese).

NOMENCLATURE.

Hamilton (**6**, pp. 303-307) included 3 varieties of Mahseer, *viz.*, *Cyprinus putitora, C. tor* and *C. mosal*, in his fourth heterogenous division of the genus *Cyprinus* which he termed *Cyprinus* proper. He observed that the fishes of this division are of large size and thick form, and are provided with a short anal fin. The genus *Cyprinus* Artedi is, however, restricted to the true Carp found in the temperate parts of Europe and Asia; it is not found in India proper, but a subspecies was described by Annandale (**1**, p. 47) from the Southern Shan States, Burma. Of the 15 species included under the division *Cyprinus* proper Hamilton recognised the close affinities of the 3 varieties of Mahseer for he (**6**, p. 303) observed under *C. putitora* that

> 'This and the two following species have, in many points, a strong resemblance, being very large fishes, affording an excellent wholesome nourishment, free from bones, although not quite so delicate as the *Rohita*. They are all also strong, well-formed, handsome fishes, peculiarly distinguished by the enormous size of their scales, which, in large individuals, almost equals the hand, insomuch, that cards for gaming are sometimes made of them at Dakha.

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[1] In the last article of this series about *Wallagonia attu*, one of the Sanskrit names mentioned for *Mulley* or *Boali* (**8**, p. 66) was *Mahasira*, in which reference is certainly made to the large front part of the fish.

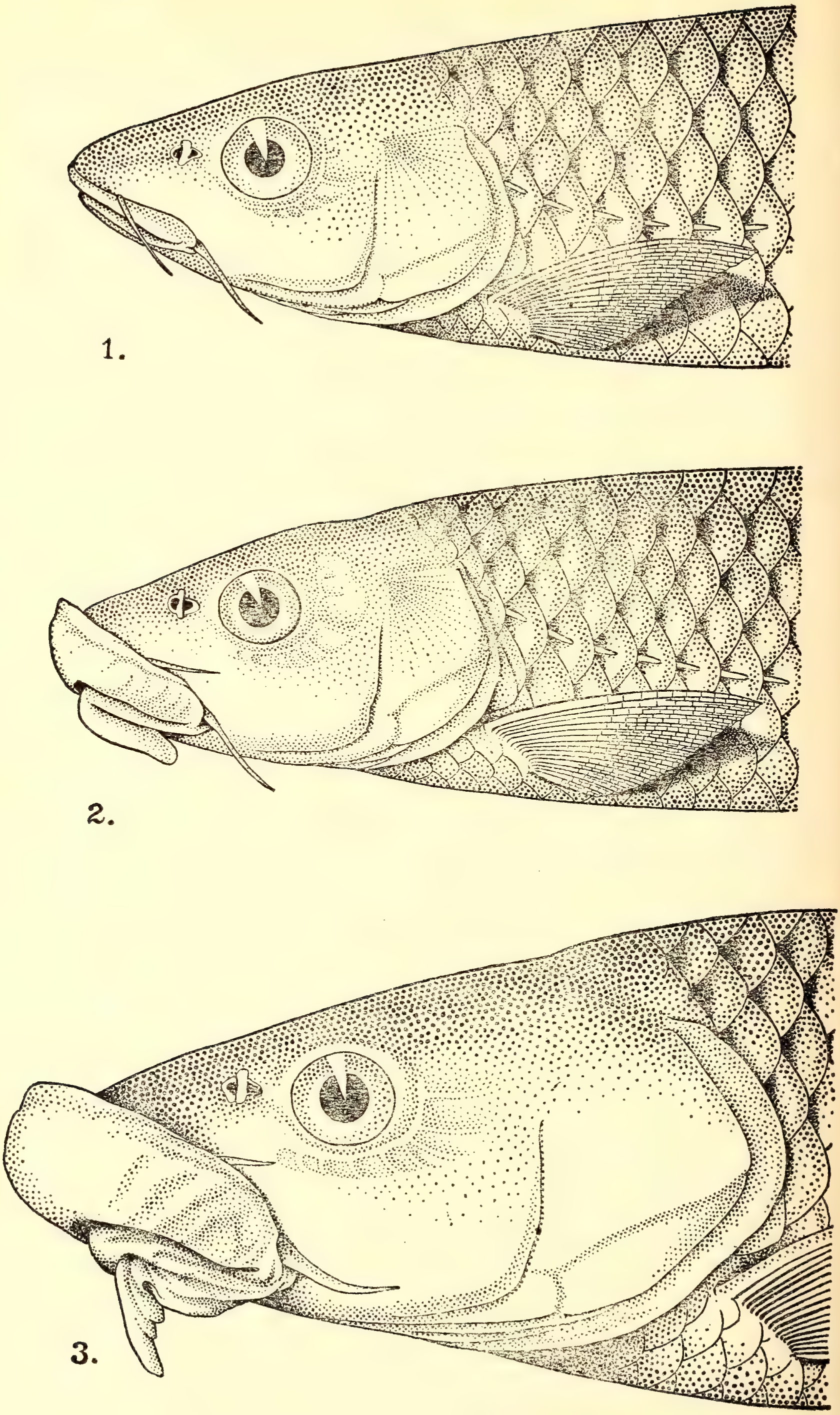
Mahasaula and *Tora*, variously altered or corrupted, or with various additions, may be considered as generic appellations among the natives for these fishes, all of which frequent large rivers.'

Unfortunately Hamilton did not figure any one of the three species in his monumental work on 'Gangetic Fishes', but among his manuscript drawings, now preserved in the Library of the Royal Asiatic Society of Bengal, he left drawings of *C. tor* and *C. mosal.* These were published by Gray (**5**) without any letterpress or acknowledgment; the latter species appears on plate 93 of Volume I of *Illustrations of Indian Zoology* under the name '*Cyprinus mosal* Hamilt.', while the former is published as '*Tor Hamiltonii*' on plate 96 of Volume II. Though the large-scaled Barbels have been variously referred to the genera *Barbus* Cuvier, *Labeobarbus* Rüppel, *Barbodes* Bleeker, *Tor* Gray, etc., according to the modern usage they are placed generally in the genus *Tor* Gray, with *Cyprinus tor* Hamilton (=*Tor Hamiltonii* Gray) as the genotype. *Barbus*, found in Europe, throughout Asia and Africa, is one of the most extensive genera of freshwater fishes, and several authors have attempted to divide it into genera and subgenera which gradually pass one into another. In the majority of cases these divisions have not been permanently accepted. Unless an attempt is made to monograph the Cyprinidae of the whole word, probably it will not be possible to define the precise generic limits of the various forms and till such time I think it may be useful to treat *Tor* as a subgenus of *Barbus*.

The fishes of the subgenus *Tor* are elongate and moderately compressed. The snout is more or less prominent. The mouth is inferior or subinferior, and horseshoe-shaped; the upper jaw is strongly protractile. The lips are more or less thick and continuous; the labial fold is uninterrupted and generally its median part is developed into a lobe which is very extensive in some individuals; in certain forms the upper lip is also greatly developed. There are two pairs of small, but well defined, barbels, one pair rostral and one pair at the angles of the mouth. The suborbital bones are narrow. The dorsal fin is provided with 8-9 branched rays and commences either before or opposite the origin of the pelvic fins; its last undivided ray is large, osseous and smooth; generally it is very strong but in certain forms it is comparatively feeble. The anal fin is short, with 5 branched rays. The scales are very large, about 23 to 30 in a series along the lateral line which runs to the middle of the base of the caudal fin. The gill-membranes are united to the isthmus. The pharyngeal teeth are spoon-shaped and are arranged in 3 series 5. 3. 2—2. 3. 5.

According to Weber and de Beaufort (**14**, p. 148), the fishes of the *Labeobarbus*-type are found in 'Fresh water of Indo-Australian Archipelago (Sumatra, Java, Borneo), of Asia and Africa.'

The Mahseers belong to a very large family of Carp, though in their size, flavour, activity, etc., they are quite different from the true Carp of Europe. It is for this reason that they are usually called Barbels. They belong to the order Cyprinoidea of the



The Putitor Mahseer, *Barbus* (*tor*) *putitora* (Hamilton).

(*For explanation see end of article*).

Physostomous fishes, to the family Cyprinidae and to the subfamily Cyprininae.

History and Description.

Hamilton (**6**, p. 388) characterized his *Cyprinus putitora* as follows :—

> 'Cyprinus verus cirrhis 4; radiis in pinna dorsali 11, duobus prioribus simplicibus, in pinna anali 7; squamis maximis; rostro laevis imperforato; labiis integerrimis; pinnis pallidis.'
> 'B 3, D 11, P 15, V 9, A 7, C 19+ .'
> 'Varietas cirrhis 2; radiis in pinna dorsali 10, in anali 8.'

The species was described by Hamilton from 'the eastern parts of Bengal', and was stated by him to grow to 9 feet in length. According to his notes on the fish and fisheries of Bengal (*vide* Day **3**, p. 50) he seems to have observed *C. putitora* only at Goalpara in the district of Rangpur. I have already quoted (p. 275) his brief account of the fish as given in these notes. Unfortunately he made no drawing of the species and his description is so generalised that the later workers found it difficult to recognise it as a valid species. McClelland (**12**, p. 399) is perhaps the only earlier ichthyologist who recorded as *Barbus putitora* a specimen collected at Ningpo in China. Hora and Mukerji (**8**, p. 140), as a result of the collections made by them in the Eastern Doons, discussed the specific limits of the three forms described by Hamilton and came to the conclusion that *B. putitora* is abundantly distinct from *B. tor* but may be conspecific with *C. mosal*. They attached considerable importance to the colour of the fins (yellow in *putitora* versus red in *tor*); to the form of the back in front of the dorsal fin (sharp in *putitora* versus convex in *tor*), and the relative size of head when compared to depth of body (head considerably greater than depth of body in *putitora* versus head considerably shorter than depth of body in *tor*). Further material collected since then has shown that all the three species of Hamilton are probably distinct. I propose to describe here the first species of Mahseers mentioned by Hamilton, e.g. *Barbus* (*Tor*) *putitora* (Hamilton).

Barbus (Tor) putitora (Hamilton).

1822. *Cyprinus* (*Cyprinus*) *putitora*, Hamilton, *Fish. Ganges*, pp. 303, 388.

D. 4/8; A. 2/5; P. 17-18; V. 1/8; C. 19.

The Putitor Mahseer is an oblong, somewhat compressed, streamlined, trout-like fish in which both the profiles are gently and gracefully arched. The head is broadly pointed anteriorly and behind the anal fin the tail becomes considerably narrow. The length of the head is always considerably greater than the depth of the body; it is contained from 3 to 3.6 times in the standard length; the head is relatively longer in younger specimens. The depth of the body is relatively greater in young individuals; it is contained from 1.1 to 1.4 times in the length of the head. The eyes are far forward and are provided with circular pupils; they are proportionately larger in the smaller individuals; the diameter of the eye is contained from 2.8 to 5.3 times in the length of the head; from 0.8 to 1.7 times in the length of the snout and from 0.7 to 1.4 times in the interorbital distance. The least height of the caudal peduncle is contained from 1.4 to 1.8 times in its length.

The mouth is small; its gape does not extend to below the eyes; it is horizontal with the opening obliquely directed upwards. The lips are fleshy and continuous at the angles of the mouth; the posterior lip is produced into a median lobe and the post-labial groove is continuous. The condition of the lips varies greatly in individuals of different sizes and in those collected from different localities (for detailed account see pages 279-280). There are two pairs of barbels[1] which are more or less of equal length and are almost as long as the diameter of the eye. The body is covered with large scales; there are 25 to 28 scales in a longitudinal series along the lateral line; 2½ rows between the lateral line and the base of the pelvic fin; 4½ rows between the lateral line and the base of the dorsal fin; 9 scales before the dorsal fin and 12 round the caudal peduncle. There is a well developed scaly appendage in the axil of the pelvic fin.

The commencement of the dorsal fin is opposite to that of the pelvics, and is almost midway between the tip of the snout and the base of the caudal fin. The last spine is very strong and bony; it is generally shorter than the depth of the body below it, but in some individuals it is equal to the body height. In a specimen from Murree, however, it is considerably longer than the depth of the body. The pectoral fins are low, considerably shorter than the head and sharp above. The pelvic fins do not reach the anal opening. The anal fin does not extend to the base of the caudal fin. The caudal fin is sharply divided, with the lower lobe somewhat more pointed.

Hamilton (**6**, p. 304) noted that the colour is dusky above 'with a gloss of steel, while the edges of the scales changed from gold to silver. The lower parts resemble entirely the latter. The fins are without spots, and the hinder ones are tinged with yellow. The eyes are like silver'.

The colours vary considerably according to the nature of the waters inhabited by the fish. In a small, fresh specimen, about 9 inches in length, collected from the Tista river near Washabari Bazaar in the Eastern Duars, the dorsal surface of the head and a small anterior portion of the body were found to be of a Lincoln green colour while the ground colour of the remaining portion of the dorsal surface of the body was warm buff which faded into light pink at the sides and silvery white on the ventral surface. On the sides, between the upper angles of the gill-openings and the base of the caudal fin, there were broad bands of light mineral gray. Each scale was anteriorly marked with a gray blotch. The portion of the tail in front of the caudal fin was marked with an irregular, broad, vertical band of amber yellow. The operculum and the sides of the snout were of gray colour while patches of orange and yellow colour were present on other parts of the head. The dorsal fin was light yellow in colour while its rays were conspicuously yellowish gray. The fin was provided with a broad band of mineral gray across the rays. The pectoral fins were pink at their bases and citron yellow distally. The pelvic fins were yellowish with a tinge of pink at their bases and extremities. The anal fin was likewise citron yellow with pink extremity. The caudal fin was also citron yellow with its rays of mineral gray colour; it was edged with pink and gray.

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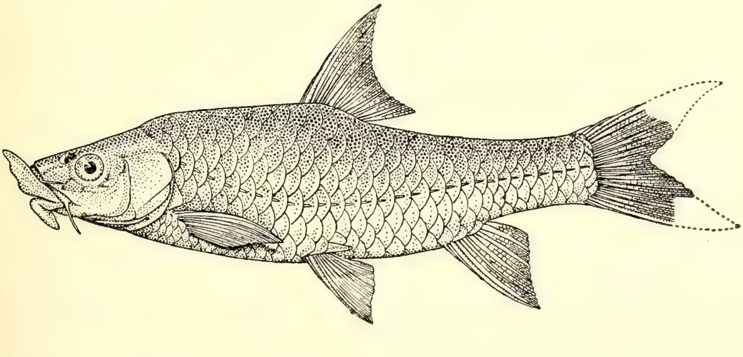
[1] Hamilton (**6**, p. 305) records that he examined one specimen in which there were only two barbels. This has to be regarded as a case of abnormality.

The colour plate reproduced here shows the colouration of a specimen about 3½ feet in length collected by Mr. W. K. Langdale Smith from the Tista river and kept in a kachha tank at the Rungli Rungliot Tea Estate, Darjeeling District. Under these artificial conditions its colouration in life was as follows :—

The back was reddish sap green and along the sides above the lateral line there was a broad band with a purplish shadow throughout. Below the lateral line the body was light orange which faded into silvery white on the belly. The head below the level of the eyes was light buff yellow which was replaced ventrally by a light neutral tint. The iris was light green while the pupil was dark blue. The scales in the upper half of the body were marked anteriorly by reddish sap green colour while in the centre they were brilliantly orange, their posterior edges were of peacock green in colour with shades of light and deep sap green anteriorly. The pectoral, pelvic, anal and caudal fins were peacock green in colour; the distal tip of the anal was marked with a patch of reddish orange, while the posterior border of the caudal fin was marked with reddish green. The tubes on the lateral line were greenish silvery.



Text-fig. 1.—Lateral view of an African species of *Barbus, B. cunningi* Gilchrist, with greatly developed lips. ×3/8.
(After Gilchrist, *Ann. South Afr. Mus.*, xi, p. 392, 1918).

Note on the enlargement of lips (*Plate II*) :—Reference has been made above (*vide* p. 278) to the hypertrophied lips of certain individuals. Such an enlargement of the lips is to be found not only in several species, races and varieties of the Indian Mahseers, but in the large-scaled Barbels of the neighbouring countries and of Africa as well. Thomas (**13**, p. 32) discussed the systematic value of this character and observed :

> 'I have found this peculiar formation occurring in all the places spoken of above, except in Northern India[1], where I have not fished enough. It cannot indicate a mere variety for I have found it so frequently. Does it indicate a species, or is it a temporary growth like the beak of a male salmon in the spawning season? It cannot be the latter, because I do not remember to have ever seen it half developed, and I have notes of having frequently observed it fully developed in small immature Mahseer of 1 lb. in weight and under, down to fry of five, five and a half, and six inches, in length, when they could hardly be breeding.'

Thomas then gives the opinion of the local fishermen who regard the thick-lipped forms as females, but in view of the fact that a 'number of such very small Mahseer being caught with the lips not partially but thoroughly developed, militates against their being females.' His conclusion is that they are distinct species. 'But what the function of these prolonged lips and beard may be I cannot conceive. It is left as a puzzle for my readers to work out.'

Hora and Mukerji (**8**, p. 140) also noted differences in the structure of the lips of various individuals collected by them in the Eastern Doons and remarked :

> 'Among the yellow-finned forms there are two types : (i) The lips are fleshy and the lower one is produced backwards into a long fleshy appendage ; the snout is blunt ; (ii) The lips are of the normal type and the lower lip does not form an appendage ; the snout is rather pointed. We believe that these differences are correlated with sex ; the former type represents the male and the latter the female.'

The above conclusion was based on an examination of immature specimens, but as these differences are sometimes fairly pronounced even in fry of a few inches in length I agree with Thomas that probably they are not secondary sexual characters.

While re-examining the material from the Eastern Doons I found that all the specimens, 8 in number, collected from the Song River at Lachhiwala possess well-developed lips while 6 specimens obtained from the Suswa River have lips of the ordinary type. From the field notes made at the time of collecting the material and from personal recollections of the nature of the two streams, it can be stated that the Song River is a large torrential stream with rocky and gravelly bed, but without any marked waterfalls. The Suswa River near Sat Narain is a comparatively sluggish stream with sandy or pebbly bed.

With regard to the enlargement of the lips Day (**2**, p. 77) noted that

> 'Amongst 20 specimens all of about 10 inches in length and taken the same day in the *Chukkee*, a hill affluent of the Sutlej, I found in two the snout

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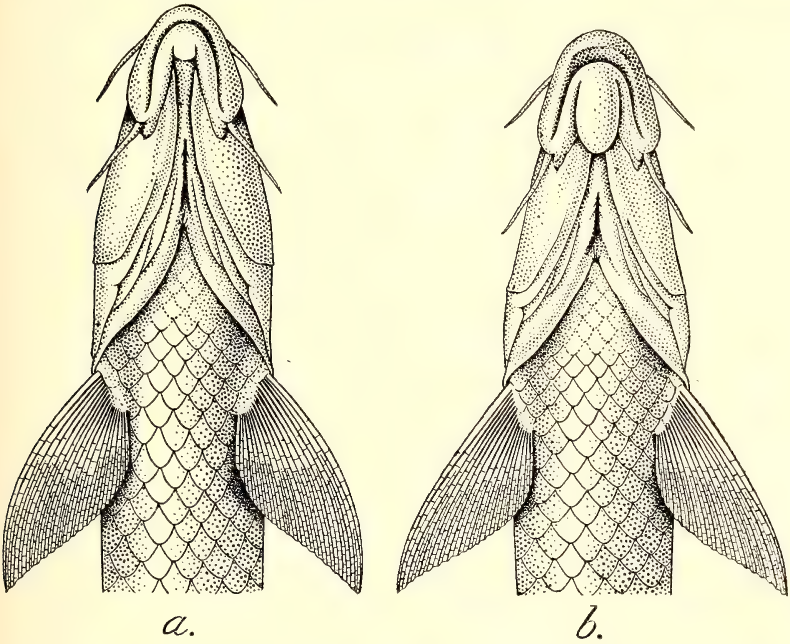
[1] Enlargement of lips is equally marked in several types of Himalayan Mahseers as will be evident from this as well as the following articles in this series.

elongated overhanging the upper jaw, in several the middle of the upper lip elongated, but to varying lengths, and in a smaller number no elongation of the upper lip. The median lobe of the lower lip was very variously produced, but apparent in all.'

It is clear from the above that Day also found the enlarged lips practically in all the specimens collected from a torrential tributary of the Sutlej River in the Himalayas.



Text-fig. 2.—Ventral surface of head and anterior part of body of two specimens of about equal size from the Eastern Doons. × $1\frac{1}{8}$.

a. A specimen, 141 mm. in total length, from the Suswa River near Sat Narain showing plain lips, and a small median lobe of the posterior lip.

b. A specimen, 140 mm. in total length, from the Song River at Lachhiwala showing hypertrophied lips, and a well-developed, beard-like median lobe of the posterior lip.

As in Carp in general, the jaws of Mahseer are protrusible so that the lips can be applied to the substratum to form a sucker. It is conceivable, therefore, that hypertrophied lips are characteristic of only those individuals which live in shallow torrential streams where they enable the fish to adhere to rocks and stones in the same way as the Lampreys do in rocky streams. The forms with thick lips generally possess a more graceful and stream-lined body which also points to their torrential habitat.

To test the above hypothesis, which for the time being may be regarded merely as a tentative suggestion, Museum collections are not helpful. For example, of 13 specimens, ranging in standard length from 116 mm. to 243 mm., of the Putitor Mahseer from the Kangra Valley, Punjab, very kindly sent by Dr. Hamid Khan, 6 possess ordinary types of lips, while in the remaining examples the lips are greatly thickened and the median lobe of 4 specimens is co-extensive with the extent of the mouth. As this lot is noted to have been collected 'from Kangra streams', it is now impossible to correlate the differences in the development of lips with differences in their habitats. To elucidate this problem it is highly desirable that anglers may kindly note the condition of the lips of the Mahseers caught by them and also make a detailed note of the length. The sex of the individual must also be noted by a rough examination of the gonads, but if it is difficult to be sure whether it is an ovary or a testis the same may be preserved and sent, with other particulars, to the Bombay Natural History Society for further study. The accumulation of these data will enable us to arrive at a satisfactory conclusion regarding the mystery that surrounds the hypertrophied condition of the lips in certain Mahseers. One thing is, however, clear that it cannot be relied upon as a character for differentiating species.

Bionomics :—As a result of their studies on the material collected from the Eastern Doons, Hora and Mukerji (**8**, p. 142) made the following observations on the feeding habits and the breeding period of the species:—

> 'In most of the specimens dissected, the stomach was found to be empty showing that the feeding is probably intermittent in this species. The alimentary canal is considerably shorter than that of *B. tor*, being 2.6 times as long as the length of the fish. The fish feeds on green filamentous algae, insect larvae, water plants, slimy matter from rocks, etc. Judged by the length of its intestine, it would appear to be more carnivorous than *B. tor*.
>
> '*B. putitora* is represented by a large number of young specimens in our collection. This species also seems to breed in August-September. The fry is provided with a black spot in front of the base of the caudal fin.'

Hamid Khan (**10**) has studied the sex organs of Mahseer of the Punjab and has come to the conclusion that 'it spawns three times in the year, and that all the eggs in the ovaries are laid at each spawning season'. The three spawning seasons are, (i) January and February, (ii) May and June (snow melts), and (iii) July to September (monsoon months). Unfortunately, Dr. Hamid Khan had no opportunity to examine the actual specimens, so it is difficult to say whether all the samples of gonads studied by him belonged to the same species. However, from the material sent to me from the Kangra Valley, referred to above, it seems probable that *Barbus* (*Tor*) *putitora* is the commonest Mahseer of the Punjab waters.

Geographical Distribution:—*Barbus* (*Tor*) *putitora* is found all along the Himalayas. Measurements of specimens from Kashmir to the Darjeeling Himalayas are included in the table given overleaf. Though it is reported (**12**, p. 399) from China also, in the present confused state of our knowledge it is very difficult to form an exact idea of its range of distribution.

MEASUREMENTS IN MILLIMETRES

	Murree	Kangra			Dehra Dun					Naini Tal & Almorah			Trebeni River, Nepal Terai	Tista River, below Darjeeling		
Total length ...	...†	150·0†	292·0*	308·0†	117·5*	184·0*	184·0†	233·5*	314·0*	...†	78·0†	106·0†	107·0†	140·0†	351·0†	1060·0†[1]
Standard length ...	138·0	117·0	238·0	242·0	90·0	140·0	140·0	180·5	248·0	45·0	60·0	82·0	82·0	103·0	291·5	850·0
Length of head ...	39·0	33·5	66·5	71·5	28·5	43·3	41·3	53·5	73·5	14·0	20·0	25·0	25·0	31·0	85·0	250·0
Width of head ...	19·0	17·0	34·0	34·0	14·0	21·0	21·0	28·5	39·0	7·0	9·5	12·5	11·5	14·0	39·5	107·2
Height of head ...	25·5	20·5	41·5	44·3	18·5	25·8	27·0	32·6	45·0	9·0	13·0	16·5	15·0	17·5	45·5	134·1
Diameter of eye ...	11·0	9·0	14·0	14·5	8·2	11·0	11·0	12·3	15·0	5·0	5·6	7·0	7·5	9·0	16·0	38·1
Length of snout ...	10·0	10·0	23·0	22·0	10·0	14·8	12·5	19·0	25·5	4·0	5·6	7·0	7·2	9·0	26·5	73·3
Interorbital width ...	10·5	9·0	20·3	19·5	7·2	11·8	11·6	14·5	20·0	3·6	5·0	6·0	6·0	7·0	21·0	61·1
Depth of body ...	29·0	29·5	57·5	58·3	22·5	31·5	35·0	40·0	57·5	12·2	16·5	20·5	21·0	26·0	67·0	150·0
Width of body ...	17·0	16·0	32·5	33·0	13·0	20·0	19·0	25·5	32·0	6·0	9·0	10·5	10·6	12·5	42·0	104·1
Length of dorsal spine ...	33·0	28·0	41·0	44·0	20·0	31·0	31·0	40·5	48·0	11·0	14·0	18·5	17·0	24·0	52·0	...
Length of pectoral fin ...	26·0	20·5	45·0	48·0	19·0	28·3	27·0	36·5	50·0	11·0	13·5	15·0	17·0	20·0	52·5	...
Length of pelvic fin ...	22·0	20·0	36·5	39·5	15·5	27·0	26·0	31·0	44·0	11·0	13·5	14·0	16·0	18·0	50·0	...
Length of caudal peduncle	23·0	18·5	42·5	44·0	14·3	25·5	25·5	32·0	42·0	8·0	10·0	14·0	14·0	17·0	47·5	150·0
Least height of caudal peduncle ...	16·0	13·5	24·5	25·0	10·0	14·8	16·0	19·5	26·5	5·5	6·5	9·0	9·8	11·5	33·5	61·8
Length of maxillary barbel	10·0	10·0	14·5	21·5	8·0	11·0	10·0	13·0	17·0	3·5	5·2	6·0	7·0	9·5	17·0	...
Length of rostral barbel.	8·0	8·0	14·0	17·0	7·0	9·0	9·0	13·5	17·0	3·0	5·0	5·8	6·3	8·5	16·0	...

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[1] Measurements given here are of the stuffed specimen.

An asterisk (*) denotes well-developed condition of the lips, while

a dagger (†) denotes that the lips are not specially enlarged.

ACKNOWLEDGMENTS.

The cost of illustrations for this article has been borne by the Bombay Natural History Society and for this my sincerest thanks are due to the authorities of the Society. I am greatly indebted to Mr. W. K. Langdale Smith of the Rungli Rungliot Tea Estate, Darjeeling District, who very kindly afforded facilities for my artist to make a colour sketch of one of his tame Mahseers, which was caught by him from the Tista River and later kept in a kachha tank in his estate. The specimen was afterwards skinned and preserved, and is now exhibited in the Fish Gallery of the Indian Museum. The colour drawing made by the artist is reproduced here. As in the case of the previous articles Mr. K. S. Misra has helped me in the preparation of the table of measurements, and for this I am indebted to him. The colour drawing was prepared by Babu B. Bagchi, while the text-figures were executed by Babu A. K. Mondul. I am obliged to them for the skill and care with which they executed the work under my supervision.

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EXPLANATION OF PLATES.

Explanation of Plate I.

Colour sketch of a tame Putitor Mahseer, *Barbus* (*Tor*) *putitora* (Hamilton), of the Tista River. The drawing was made from a smaller specimen.

The specimen, 1,060 mm. in total length, was collected by Mr. W. K. Langdale Smith and kept in a kachha tank at the Rungli Rungliot Tea Estate, Darjeeling District. The colours shown in the drawing probably differ from those of a specimen living under natural conditions. In examples of this type of Mahseer collected from torrential rivers the paired fins are generally pale in colour **(8)**.

Explanation of Plate II.

Lateral view of head and anterior part of body of 3 specimens of Putitor Mahseer from the Eastern Doons.

1. A specimen, 141 mm. in total length, from the Suswa River at Sat Narain showing plain lips. *ca* Nat. Size.
2. A specimen, 140 mm. in total length, from the Song River near Lachhiwala showing hypertrophied lips. ×1 5/16.
3. A specimen, 108 mm. in head length, from the Song River at Lachhiwala with greatly hypertrophied lips. *ca* Nat. Size.

The lips are partially stretched outwards to show their form and extent.

(*To be continued*)

THE BIRD YEAR IN BETUL (CENTRAL PROVINCES).

BY

C. E. HEWETSON, I.F.S.

The excuse for such an inexpert article is that the study of birds in the Central Provinces has attracted few people and the records from these parts are very meagre.

The Central Provinces are not a natural geographical unit. The topography, climate and distribution of the flora and fauna intergrade with the surrounding provinces. There is, for instance, a vast difference between the Godavary valley in Chanda district and the Narbada valley in Hoshangabad district. It is probable that in a careful survey of the whole province a large percentage of Indian birds would be found. A list of birds from the whole province for this reason is not very informative and in this article I deal chiefly with the birds of Betul district.

Betul district is the centre of India and was once vaguely considered for the head-quarters of the Central Government. The greater part lies in the Satpura range and consists of a plateau with an average elevation of 2,100 ft. The Tapti river rises near Multai in the south. The northern part of the plateau drains into the Narbada river. The plateau itself is mostly cultivated but the slopes of the plateau are covered with forest. Below the slopes there are numerous streams which contain a certain amount of water throughout the year. The bird population described in the article lives in these forests. The habitat is fairly uniform. The country is all hilly and the forest is the mixed deciduous association with a more or less dense second storey of bamboos. A large percentage of the forest is government reserve and due to sixty years of fire protection tends to be mesophytic. These conditions are ideal for a large number of bird species, and I think one of the striking aspects of these forests is the large bird population. There are no tanks or lakes in the area, and this explains the absence of the majority of water birds.

The lists of birds are compiled on visual identification only; but I have tried to be as rigorous as possible. I have only included species whose identification could be checked repeatedly. One disadvantage is that I am unable to give geographical races. Betul is close to the boundary between many Northern and Southern races and probably both races often occur. In the monthly lists I have shewn only the birds seen. The absence of a bird does not necessarily mean that it was migratory. In the notes on species I have given details of species which are probably migratory.

One of the interesting points brought out is the discontinuous distribution of several species. This is true not only of birds but also of animals and plants. The higher parts of the Satpura range enjoy a moderately cool climate and remain green and fairly moist almost throughout the year. The more interesting examples are the Nilgiri Black bird, the Deccan Scimitar Babbler, the Whistling Thrush, the Pied Shrike and the Red-Whiskered Bulbul.

There is one consideration which restricts the value of my observation. Being a forest officer I am continuously moving and only stay two or three days in one place. This means that in the course of a year I see the greater part of the District, but I am unable to say whether a rare bird is a regular inhabitant of one locality or whether the bird's visit and mine happened to coincide.

Regular bird watching over a year shews that there is considerable local movement of the resident species. The dates of arrival and departure of the migratory species are based on ten years observation in various parts of the Central Provinces. Where my opinion conflicts with previous observers I am prepared to back my observations for a modest sum.

NOTES ON SPECIES.

(The scientific names are taken from Whistler's *Hand Book,* second edition and the *Vernay Survey of the Eastern Ghats* : I have added the locality in which some of the rarer species were seen.)

TITS (*Paridæ*).

Parus major Linn.

Machlolophus xanthogenys (Vigors).

These are both common birds throughout the forests. *Parus major* may be locally very abundant.

NUTHATCHES (*Sittidæ*).

Sitta castanea Lesson.

This is not a common species and I have only seen it outside the forest. *Sitta frontalis* is common locally, but is not widely spread (Selda Reserve). One would expect these to be common species.

BABBLERS (*Timalidæ*).

Turdoides somervillei (Sykes).

Abundant throughout the district. The colouration varies obviously and I should judge that both races occur equally. There is one albino in a family near my bungalow. *Argya caudata* is not a forest species but is frequent in the open. *A. malcolmi* is common round Betul town but is not a forest species. It is irregularly distributed.

Pomatorhinus horsfieldii Sykes.

Seen occasionally (Murha and Sarni). Once at an elevation of 1,800 ft. and once at 2,700 ft. The only other record is from Pachmarhi.[4]

Dumetia hyperythra (Frankl.).

A common species found in all types of forest but more usually in grassy areas, such as coupes closed to grazing.

Pellorneum ruficeps Swains.

Occurs in the higher forests. It is locally common.

Alcippe poioicephala (Jerdon).

Common particularly in bamboo forest.

Aegithina tiphia Linn.

Less frequent in the forest, and is less common in this district than in the south of the province.

Chloropsis jerdoni (Blyth).

This bird is more common than one at first realizes. It is remarkably noisy and mimics other birds.

BULBULS (*Pycnonotidæ*).

Molpastes cafer Linn.

The only Bulbul in the greater part of the area.

Otocompsa jocosa Linn.

Only found at elevations over 2,300 ft. and I have seen it only in one or two places where it is locally abundant. This agrees with its habits as reported by D'Abreu[5] and Bates[4]. At Pachmarhi it is common on the slopes of Dhupgarh (4,000 ft.). This species is also common at Chikalda (3,500 ft.). Generally speaking Bulbuls are poorly represented in the province.

Pycnonotus luteolus (Less.).

Occurs in Nagpur; and I suspect that the Yellow-vented Bulbul is locally distributed. An old inhabitant of Betul insists that there were green bulbuls when she first came. The specimens of *Otocompsa jocosa* always appear to be considerably larger than *Molpastes cafer*; and it is a forest species, and decidedly shy in this area.

CHATS, ROBINS, THRUSHES, ETC. (*Turdidæ*).

Phoenicurus ochrurus (Gmelin).

A very common species both in the more open parts of the forest and round cultivation. It is one of the most punctual of our migrants arriving on October 1st and leaving about April 1st.

Saxicoloides fulicata (Linn.).

Copsychus saularis (Linn.).

Well distributed throughout the forest. The latter species is perhaps one of the most regular inhabitants. The Shama does not occur in the Central Provinces except perhaps rarely in the South.

Turdus simillimus Jerd.

The distribution of this species appears to be very discontinuous. Outside the province the nearest localities are Mount Aboo, the Eastern Ghats and Kandahar in Hyderabad. In the Central Provinces it is common at Chikalda and round Dhupgarh near Pachmarhi. It has been recorded from Seoni district by D'Abreu. I have found it in two localities in Betul. One was a small valley about 10 miles east of Betul town (2,200 ft.) and the second on an isolated plateau Killindeo (3,500 ft.) which is close to Pachmarhi. Where found it is abundant. The birds on Killindeo were just starting to sing. It probably occurs here and there throughout the Satpura range. I suspect that the birds are resident. I wonder whether individuals ever migrate from one colony to another.

Geokichla citrina cyanotis (Jard. & Selby).

Found throughout Betul district and as far as I know throughout the province. It is a resident species. It occasionally occurs in gardens but the typical habitat are the nalas in the forest where *Eugenia jambolana* and *Terminalia Arjuna* give shade throughout the year. Here they may be very common. They are usually in pairs and are active in the shade throughout the day. They are very quiet birds and unobtrusive. I have heard a bird in song on April 15th but I think the breeding season is later.

Monticola solitaria (P.L.S. Müller).

Widely distributed species in the cold weather from October to the middle of April. It is one of the last of the migrants to leave. It is common both in forest and villages.

Myophonus horsfieldii Vigors.

Found here and there on the streams where they descend from the plateau over rocky precipices. The strongholds of this species are however the streams running off the Pachmarhi plateau. This species is very common there. They start their well-known school boy whistle in May. It occurs where conditions are suitable in the Betul forests. It is a resident species.

FLY-CATCHERS (*Muscicapidæ*).

The Fly-catchers are well represented and are one of the most generally distributed and abundant groups. It will be seen that groups which take their food on the wing are all common species and these forests must support an immense insect population.

Siphia parva Bechstein.

Common in the winter and leaves comparatively late.

Muscicapula tickelliae Blyth.

Perhaps our most typical forest species and widely distributed.

Eumyias thalassina Swainson.

An occasional winter visitor.

Culicicapa ceylonensis Swainson.

A resident bird and widely distributed but not common.

Hypothymis azurea Boddaert.

About equally common with the last and my impression is that it is more common in the hot weather.

Terpsiphone paradisi Linn.

Definitely a summer visitor. It is not common in Betul but I give my observations based on five years in Bhandara and Chanda districts. There it arrives regularly in the last week of March and is common in suitable places in April and May. After May I am less certain but my impression is that the majority of birds leave at the break of the rains. A few birds are seen in July and August and a bird or two may be seen in the cold weather; but the main occurrence is as stated. Their favourite haunts are the nalas where water remains throughout the hot weather. Here the trees are in leaf in April and May and it is one of the finest sights in the world to watch these lovely birds hawking insects in these green fringed *nalas*. I have no record of the birds breeding but suggest that only a small proportion of birds breed here. I am unable to say which race our birds belong to.

Leucocirca aureola Lesson.

Our common species both in the forest and outside.

Leucocirca pectoralis Jerdon.

Occasionally seen in Betul and may be one of the species which prefer the higher elevations. It is the common species at Chikalda.

SHRIKES (*Lanidæ*).

Lanius schach Linn.

Lanius vittatus Valenciennes.

Occur throughout the forest.

Lanius cristatus Linn.

Only seen once in April, but I fancy it occurs fairly regularly.

Lanius excubitor Linn.

I have not found this shrike in Betul but it is a fairly regular inhabitant of the east of the province.

Hemipus picatus (Sykes).

An interesting species. It is not given by Osmaston[3] in his list of Pachmarhi birds but is mentioned as occurring in the Satpuras by D'Abreu: I have not seen it in any other part of the province. It is not given in Briggs'[2] list of birds of Mhow. The *New Fauna* gives the hills of the Deccan as one of the localities, but it is not recorded in the Hyderabad State Survey. I only saw a few individuals and never more than two birds at a time.

Tephrodornis pondicerianus Gmelin.

An abundant species both inside the forest and outside.

MINIVETS (*Pericrocotidæ*).

Pericrocotus speciosus semiruber Whistler & Kinnear.

Almost certainly a resident species and I have seen in it in most months. The males were engaged in courting flights at the beginning of May.

Pericrocotus brevirostris Vigors.

A winter visitor.

Pericrocotus peregrinus (Linn.).

A common species outside the forest but rare in the denser growth.

Pericrocotus erythropygius (Jerdon).

Seen occasionally more usually in open grassy forest, such as regeneration areas, and is less arboreal than the other species. I do not know whether it is resident.

CUCKOO-SHRIKES.

Lalage sykesi Strickl.

Found; but the common species of this group is *Graucalis javensis* which is abundant throughout the district in the forest and the open. They appear to be more common in the hot weather.

SWALLOW-SHRIKES (*Artamidæ*).

Artamus fuscus Vieill.

I have only seen a party of *Artamus fuscus* once in the Central Provinces in my service. That was this year in February in the centre of a large compact area of forest. I am fairly certain it is not common but negative information is untrustworthy. It is not shewn in D'Abreu's list.[1]

KING CROWS (*Dicruridæ*).

Dicrurus macrocercus (Vieill.).

Widely distributed throughout the district.

Dicrurus longicaudatus Blanf. & Oates.

I have not recorded this shrike but this is possibly due to my failure to distinguish specimens.

Dicrurus coerulescens (Linn.).

This is the typical Drongo of the forest. A very attractive bird and less forbidding than the King Crow. It is also a fine whistler and has many pleasing notes. It often whistles very quietly as if trying over the notes under its breath. Its general habits are the same as those of the other Drongos except that it is more aboreal and is not found in cultivation.

Dissemurus paradiseus (Linn.).

D. p. malabaricus (Lath.).

Find these bamboo forests very suitable and is abundant.

Probably both occur as there is an obvious difference in size of the birds seen. This is one of the most attractive of all birds and appears to find time to practise its vocal talents. The range and variety of the notes is great.

WARBLERS (*Sylvidæ*).

I omit the Warblers as my notes are not sufficiently full.

Orthotomus sutorius Pennant.

Is common.

Franklinia buchanani Blyth.

Is occasional.

Prinia socialis (Licht.) and **Prinia inornata** (Sykes).

Occur locally.

ORIOLES (*Oriolidæ*).

Oriolus oriolus (Linn.).

Apparently a summer visitor. I have only recorded it in April and May and once in September. Further observations however are necessary.

Oriolus xanthornus (Linn.).

The common resident species being common in the forest and the open country.

STARLINGS, MYNAHS (*Sturnidæ*).

Sturnia malabarica (Gmelin).

Rare or absent in Betul and I have no definite record of it. It is however common in large flocks in March and April in the south of the Province. It is certainly more common at that time of year; but whether it is entirely absent at other times, I am uncertain.

Temenuchus pagodarum (Gmelin).

Fairly common all over Betul district.

Acridotheres tristis (Linn.).

Also abundant throughout.

Acridotheres ginginianus (Lath.).

Not met with in Betul, but I have seen it near Katni in the Jubbulpur district.

Aethiopsar fuscus (Wagl.).

Certainly not a common species in the Central Provinces; but I think I have seen it once or twice this year in Betul. The bird, I suspect to be it, was certainly a Mynah and not either the Common or Bank Mynah so by elimination I consider it likely to have been *Aethiopsar fuscus*.

Sturnopastor contra Blanf. & Oates.

Also not a Betul bird, but I have seen it locally in Bhandara district. The distribution of the mynahs appears to be very erratic in the Central Provinces.

WEAVER BIRDS (*Ploceidæ*).

Ploceus philippinus (Linn.).

A rare bird in Betul, probably in the absence of tanks and watery ground. It is frequent in other parts of the province.

Uroloncha malabarica (Linn.).

The common species being moderately common throughout; but it is more common in open cultivation.

Stictospiza formosa (Lath.).

I have seen it once in the west of the district towards the Nimar border. I visited the same locality a second time but did not see any birds. The male is a very neatly marked individual. I have no records of other species of Munia but I suspect that *Uroloncha striata* occurs. It seems a very skulking bird and on neither occasion could I get a clear view but there is no other bird which answers the description I wrote down and it certainly was a Munia of sorts.

FINCHES (*Fringillidæ*).

Carpodacus erythrinus (Pall.).

Occurs in January and February and may be locally common, particularly in areas under regeneration.

Gymnorhis xanthocollis (Burton).

This is another species of whose status I am doubtful. I have only recorded it from December to June. In March and April it is exceedingly abundant all over the forest; and, if anyone loses their birds, we could account for the majority. In May it is seen in quite large flocks. I think that the majority of birds must leave us in the rains. It breeds in March and April and is then very prominent and the vigorous chirping fills the forest. Afterwards however it is much less obtrusive.

Passer domesticus (Linn.).

Always with us.

Emberiza melanocephala Scop.

Emberiza icterica Eversm.

Both occur in flocks in February and March when the cold weather crops are ripening. In the south of the province it is seen in January and it probably follows the ripening of the crops to the north. Curiously I have never recorded either species in September to December.

Melophus lathami Gray.

A local migrant. I have seen birds in all months of the year, but it is more common in December to February. This year it was quite abundant locally both round forest villages and in the forest. Several individuals may be found together in a loosely associated flock, but it appears less gregarious than other species of this group.

MARTINS AND SWALLOWS (*Hirundinidæ*).

Riparia chinensis Gray.

Occurs locally.

Riparia concolor (Sykes).

Also found.

Hirundo smithii Leach.

The common local species of this group both in the open and the forest. It is of course more common near water, but occurs also in fairly dry areas.

Hirundo daurica Linn.

Found here and there; but I associate it with the more inaccessible and deserted parts of the forest. I have insufficient data to enable me to say whether it is migratory.

WAGTAILS, LARKS AND PIPITS (*Motacillidæ*).

Motacilla alba Linn.

Abundant in the cold weather, arriving in the first week of October. A wave of these birds seem to arrive and for a few days they are as thick as leaves. They leave in the middle of April.

Motacilla maderaspatensis (Gmelin).

Found regularly on the larger nalas and other water. They breed in April.

Motacilla cinerea Tunstall.

Our earliest migrant to arrive in the second half of September and leaves nearly the last after the 15th April. One of these birds will occur wherever water is found even in the remotest forest.

Motacilla flava Linn.

Occurs sparingly.

Anthus hodgsoni (Richmond).

Widely distributed from November to May.

Anthus rufulus Vieill.

I am discreetly non-committal about this species as I am not sure whether I have not confused it with one of the larks. About the Larks I am also doubtful in my identifications.

Mirafra erythroptera Jerdon.

A widely distributed species.

Alauda gulgula Franklin.

Common.

Eremopteryx grisea (Scop.).

A winter visitor in my opinion. Anyhow it is less common in the summer and I have only recorded it from February to May.

WHITE-EYES (*Zosteropidæ*).

Zosterops palpebrosa (Temm.).

One of our abundant species both in the forest and the mango groves in the open areas.

SUNBIRDS (*Nectarinidæ*).

Cinnyris asiaticus (Lath.).

The only sun-bird of these parts and is common all over the district.

Cinnyris zeylonicus (Linn.).

Only occurs, if at all, in the south of the province.

PITTAS (*Pittidæ*).

Pitta brachyura (Linn.).

One of our summer visitors. It is rare in Betul, but was a very common species in the denser bamboo forest of Chanda district. There it used to arrive in May and probably left in September or October. It probably breeds in the Central Provinces as I have seen nests which answer to the description of Pitta's nests.

WOODPECKERS (*Gecinidæ*).

Brachypternus bengalensis (Linn.).

Our common wood-pecker, and it might be described as abundant throughout our forests.

Dryobates mahrattensis (Lath.).

Also common.

Dryobates hardwickii (Jerd.).

Generally distributed.

These are the common species; at least one more occurs, but I have never had a clear view.

BARBETS (*Capitonidæ*).

Thereiceryx zeylanicus (Gmel.).

Very abundant.

Xantholaema haemacephala (Müller).

Common.

ROLLERS (*Coracidæ*).

Coracias bengalensis (Linn.).

Widely distributed and penetrates right into the forest. It does not ascend very high and is uncommon on the Chikalda plateau.

BEE-EATERS (*Meropidæ*).

Merops orientalis Lath.

The common species.

Leaves the plateau during the rains from July to September. It occurs in the plains of the Central Provinces throughout the rains but my impression is that it is less common at this time.

Merops superciliosus Linn.

I have not recorded at all in Betul.

KINGFISHERS (*Alcedinidæ*).

Ceryle rudis Linn.

Not common, as suitable water is rare; but it occurs on the larger nalas.

Alcedo atthis (Linn.).

Common and well distributed.

Halcyon smyrnensis (Linn.).

The typical species of this group, and occurs throughout our forest very regularly. It is apparently the victim of one of the birds of prey as I have found remains two or three times.

Ramphalcyon capensis gurial (Pearson).

Also a regular inhabitant of stretches of permanent water in the forest. It is found in similar places in Chanda as well.

All four species are resident. The last species is excessively noisy and has a loud ringing call which is unusual.

HORNBILLS (*Bucerotidæ*).

Tockus birostris (Scop.).

A common species throughout.

Authracoceros coronatus (Bodd.).

I have seen one party of this at one of the higher parts of the plateau in December.

HOOPOE (*Upupidæ*).

Upupa epops Linn.

A regular inhabitant, and is partially migratory. It is less common in the rains and more common in the cold weather.

SWIFTS (*Cypselidæ*).

Micropus affinis (Gray).

Found here and there.

Micropus melba (Linn.).

I think also occurs regularly, but I have only noted it once without doubt.

Hemiprocne coronata (Tickell).

A regular jungle species; but I did not know the identity of the bird, when I first came, so that it does not occur in the records until March.

NIGHTJARS (*Caprimulgidæ*).

Caprimulgus macrurus Horsf.

Regarding the Indian Nightjars I am doubtful as my identifications largely depend on their calls. On this basis and going by the descriptions of the call given in Whistler's *Hand Book* and the *New Fauna* I consider *Caprimulgus macrurus* to be the common forest species.

Caprimulgus indicus Lath.

Caprimulgus asiaticus asiaticus Lath.

More occasional. The birds are fairly common throughout the forest. They start to call from the middle to end of March. The calling is most vigorous at dusk and a second crescendo announces the dawn.

CUCKOOS (*Cuculidæ*).

The Cuckoos. I offer my observations on this group with a certain amount of hesitation. Granting that one more often hears these birds than sees them, I find it difficult to acknowledge that in ten years I should have regularly failed to see any birds in the cold-weather—if they stayed with us.

Cuculus canorus Linn.

In my opinion it arrives towards the end of April to the beginning of May.

Cuculus micropterus Gould.

Arrives about the same time.

Hierococcyx varius (Vahl.).

More or less a resident.

Clamator jacobinus (Bodd.).

Definitely migratory arriving with the break of the rains, roughly speaking in the second half of June.

Eudynamis scolopaceus (Linn.).

Also fairly certainly migratory but arrives earlier than the other species about the middle of March to early April. The dates of departure of this species are much more difficult to fix but I think they leave about the middle of September which represents the turn of the year with us.

Toccocua leschenaultii Lesson.

A widely distributed bird in jungle with a certain amount of grass. This is one of the quietest and most unobtrusive bird that I know.

Centropus sinensis Stephen.

Also widely distributed but is more common in cultivation and open country than in the forest. Both these species are resident.

PARAKEETS (*Psittaculidæ*).

Psittacula eupatria (Linn.).

Psittacula krameri (Scop.).

Psittacula cyanocephaia (Linn.).

Abundant. Perhaps *Psittacula cyanocephala* is the most frequent in the forest.

OWLS (*Asionidæ*).

I do not claim that my records of the owls are in any way complete and even the ones I have recorded may be wrongly identified.

Ketupa zelonensis (Gmel.).

Fairly common along the larger nalas.

Bubo bengalensis (Franklin).

Also fairly widely distributed.

Otus sunia (Hodgs.).

Frequent in Betul district. This bird advertises itself by its characteristic call and going by the call its distribution is very irregular. I heard it in the *sal* forests in the east of the province, when I first entered the service; but for ten years, until I came to Betul, I did not hear it in the south or north of the province.

Athene brama (Temm.).

Common throughout. This owl will stay out quite late in the mornings and when the white ants are flying will continue hunting until the sun is well up. There are few birds who do not take advantage of the white ant swarms. Of the birds I have seen feeding I think the Green Barbet is the least adapted to taking food on the wing.

VULTURES (*Gypiidæ*).

Sarcogyps calvus (Scopoli).

Ordinarily common.

Pseudogyps bengalensis (Gmelin).

The chief species of the Central Provinces.

Gyps indicus (Scopoli).

Also occurs.

Neophron percnopterus (Linn.).

Widely distributed. Some birds found near small jungle villages look more tidy than the usual run of birds.

EAGLES, FALCONS, KITES ETC. (*Ealconidæ*

Falco tinnunculus (Linn.).

As far as I know a winter bird in Betul. It is fairly common from October to March.

I have no definite records during the last year of any eagles.

Spizaëtus cirrhatus (Gmelin).

Well distributed but in no way common.

Spilornis cheela (Lath.).

A more common forest species being found close to water.

Butastur teesa (Frankl.).

The common and abundant species of small hawk in these parts. It is one of the birds that appear to spend very little time feeding. It is generally either soaring or sitting lumpily on a tree.

Haliastur indus (Bodd.).

Only occasionally seen on the larger nalas.

Milvus migrans (Bodd.).

Widely distributed. Jungle birds always seem to be larger and darker than those seen round towns. Perhaps the town birds rely on scavenging while jungle species must vary their diet with more natural food.

Circus macrourus (S. G. Gmel.).

I am uncertain of the correctness of my identification of the Harriers but I think this is the common species. These birds arrive in October and leave in February or early March.

Astur badius (Gmelin).

Common in forest and cultivation.

Accipiter nisus (Linn.).

I have no certain record of this, but I think it does occur. I am also doubtful of the occurrence of either the Lugger or the Hobby.

Pernis ptilorynchus (Temm.).

A common jungle species.

Pigeons and Doves (*Columbidæ*).

Crocopus phoenicopterus (Linn.).

Very common.

Muscadivora aenea (Linn.).

A resident in Chanda district but only in small parties in very restricted localities.

Chalcophaps indica (Linn.).

I should like to draw attention to the occurrence reported by D'Abreu in Balaghat district. This is probably the only locality as I have served in the districts surrounding Balaghat without seeing it. This is an excellent example of discontinuous distribution as the nearest localities are the Western Ghats, Himalayas and Behar and Orissa.

Columba livia Gmelin.

Occurs occasionally as a forest bird where suitable rocky sites are found but more usually it is associated with old buildings or towns.

Streptopelia orientalis agricola (Tickell).

A fairly common forest bird and a resident species.

Streptopelia chinensis (Scop.).

The common dove of the forests.

Streptopelia senegalensis (Linn.).

Less of a forest species and not particularly common in this district.

Streptopelia risoria (Linn.).

Also not a true forest species and is more usually found in the open country.

Oenopopelia tranquebarica Herm.

Also a bird of open country. Does the male bird migrate? From about August to November I did not note a male bird.

SANDGROUSE (*Pteroclidæ*).

Pterocles indicus (Gmelin).

The common sand-grouse of most of the province. Most of the year it is found in pairs scattered in the forest; but in August and September small covies are seen. These are probably family parties. In the rains they are found in more open country and on suitable sites a large number of birds may be found together. These are the drier areas which stand above the general level of cultivation. There is a famous shoot in the south of the province where 200 birds may be seen in the air together. This sand-grouse drinks after dusk and as far as I know only once a day.

PEACOCK, JUNGLE-FOWL, QUAILS, ETC. (*Phasianidæ*).

Pavo cristatus Linn.

Gallus sonnerati Temm.

Both common.

Galloperdix spadicea (Gmel.).

Also widely distributed in the forest particularly in bamboo jungle.

Coturnix coturnix (Linn.).

Fairly common in open country.

Perdicula asiatica (Lath.).

Francolinus pictus (Jard. and Selby).

A forest species.

Francolinus pondicerianus (Gmelin).

Both fairly common in open forest.

STONE-PLOVERS (*Oedicnemidæ*).

Oedicnemus oedicnemus (Linn.).

An occasional inhabitant of more open forest. It seems to shun any forest where the growth is at all dense.

PLOVERS, LAPWINGS (*Charadriidæ*).

Lobivanellus indicus (Bodd.).

A very regular forest inhabitant and no open ground is without a pair.

Lobipluvia malabarica (Bodd.).

Not a forest species, but occurs fairly regularly on the plateau and in cultivation below.

Hoplopterus duvaucellii Lesson.

Found in pairs on the larger nalas.

Charadrius dubius (Scop.).

Found here and there on the larger nalas.

Tringa hypoleucus Linn.

A frequent species at all water.

TERNS (*Sternidæ*).

Sterna aurantia Gray.

Seen occasionally.

CORMORANTS (*Phalacrocoridæ*).

Phalacrocorax niger (Vieill).

Can find enough food on some of the larger streams.

STORKS (*Ciconidæ*).

Dissoura episcopus (Bodd.).

Another occasional resident.

EGRETS AND HERONS (*Ardeidæ*).

Egrets are found on some parts of the plateau but are not common.

Ardeola grayii (Sykes).

Also only found occasionally.

Butorides striatus (Linn.).

Found fairly regularly on forest streams.

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3. Osmaston, *J.B.N.H.S.*, vol. xxviii, 2.
4. Bates, *J.B.N.H.S.*, vol. xxxi, 4.
5. D'Abreu, *J.B.N.H.S.*, vol. xxxv, 1.

MONTHLY LIST OF BIRDS OBSERVED

× shews bird seen. a shews bird definitely absent.

Species.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Remarks.
Corvus macrorhynchos ...	×	×	×	×	×	×	×	×	×	×	×	×	
Corvus splendens ...	×	×	×	×	×	×	×	×	×	×	×	×	
Dendrocitta vagabunda ...	×	×	×	×	×	×	×	×	×	×	×	×	
Parus major ...	×	×	×	×	×	×	×	×	×	×	×	×	
Machlolophus xanthogenys.	×	×	×	×	×	×	×	×	×	×	×	×	
Sitta castanea ...	...	×	×	...	...	...	...	...	...	...	...	×	Seen near Betul.
Sitta frontalis ...	...	...	×	...	×	...	...	...	...	..	...	...	Seen in one locality.
Turdoides somervillei ...	×	×	×	×	×	×	×	×	×	×	×	×	
Argya caudata ...	×	×	×	×	×	×	×	×	×	×	×	×	
Argya malcolmi ...	×	×	×	×	×	×	×	×	×	×	×	×	
Pomatorhinus horsfieldii.	...	...	...	×	×	...	...	...	..	...	...	...	Local.
Dumetia hyperythra ...	×	×	×	×	×	×	×	×	×	×	×	×	
Pellorneum ruficeps ...	...	...	...	×	×	...	...	...	...	...	...	..	Local.
Alcippe poioicephala ...	×	×	×	×	×	×	×	×	×	×	×	×	
Aegithina tiphia ...	×	×	×	×	×	×	×	×	×	×	×	×	
Chloropsis jerdoni ...	×	×	×	×	×	×	×	×	×	×	×	×	
Molpastes cafer ...	×	×	×	×	×	×	×	×	×	×	×	×	
Otocompsa jocosa ...	...	...	...	...	×	...	...	...	...	...	...	×	Local.
Saxicola caprata ...	×	×	×	×	×	×	×	×	×	×	×	×	
Saxicola torquata ...	×	×	×	a	a	a	a	a	a	a	×	×	
Phoenicurus ochrurus ...	×	×	×	×	a	a	a	a	×	×	×	×	
Saxicoloides fulicata ...	×	×	×	×	×	×	×	×	×	×	×	×	
Copsychus saularis ...	×	×	×	×	×	×	×	×	×	×	×	×	
Turdus simillimus ...	...	...	...	×	×	...	...	...	...	...	...	...	Local.
Geokichla citrina ...	×	×	×	×	×	×	×	×	×	×	×	×	
Monticola solitaria ...	×	×	×	×	a	a	a	a	a	×	×	×	

MONTHLY LIST OF BIRDS OBSERVED—(*continued*).

× shews bird seen. a shews bird definitely absent.

Species.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Remarks.
Myophonus horsfieldii ...	×	...	×	×	×	...	...	...	...	...	...	...	Local.
Siphia parva ...	×	×	×	×	a	a	a	a	a	×	×	×	
Muscicapula tickelliae ...	×	×	×	×	×	×	×	×	×	×	×	×	
Eumyias thalassina ...	×	×	...	a	a	a	a	a	a	a	...	×	
Culicicapa ceylonensis ...	×	×	×	×	×	...	...	...	...	...	...	×	
Terpsiphone paradisi ...	a	a	a	×	×	×	×	×	×	a	a	a	
Hypothymis azurea ...	...	×	×	×	×	...	...	...	...	...	...	...	
Leucocirca aureola ...	×	×	×	×	×	×	×	×	×	×	×	×	
Leucocirca pectoralis ...	...	...	...	...	×	×	...	...	...	...	...	...	Chikalda once, Betul once.
Lanius vittatus ...	×	×	×	×	×	×	×	×	×	×	×	×	
Lanius schach ...	×	×	×	×	×	×	×	×	×	×	×	×	
Lanius cristatus ...	...	...	...	×	...	...	...	...	...	...	...	...	Migrant.
Tephrodornis pondicerianus.	×	×	×	×	×	×	×	×	×	×	×	×	
Hemipus picatus ...	...	...	×	×	×	...	...	...	...	...	...	...	Local.
Pericrocotus speciosus semiruber ...	×	×	×	×	×	×	×	×	×	×	×	×	
Pericrocotus brevirostris ...	×	...	...	a	a	a	a	a	a	...	...	×	Migrant.
Pericrocotus peregrinus ...	×	×	×	×	×	×	×	×	×	×	×	×	
Pericrocotus erythropygius	...	×	...	...	...	...	...	...	...	...	...	...	Local.
Lalage syksii ...	...	...	...	...	×	...	...	...	...	...	...	...	
Graucalus javensis ...	×	×	×	×	×	×	×	×	×	×	×	×	
Artamus fuscus ...	...	×	...	...	...	...	...	...	...	...	...	...	Status unknown.
Dicrurus macrocercus ...	×	×	×	×	×	×	×	×	×	×	×	×	
Dicrurus coerulescens ...	×	×	×	×	×	×	×	×	×	×	×	×	
Dissemurus paradiseus ...	×	×	×	×	×	×	×	×	×	×	×	×	
Orthotomus sutorius ...	×	×	×	×	×	×	×	×	×	×	×	×	

MONTHLY LIST OF BIRDS OBSERVED—(*continued*).

× shews bird seen. a shews bird definitely absent.

Species.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Remarks.
Franklinia buchanani ...	...	×	...	..	...	...	...	...	...	...	...	...	Probably occurs.
Prinia socialis ...	...	...	...	×	×	×	...	...	...	...	...	...	Do.
Prinia inornata ...	...	...	...	×	×	...	...	...	...	...	...	...	Do.
Oriolus oriolus ...	...	...	...	×	×	×	...	...	×	...	...	..	Probably migratory.
Oriolus xanthornus ...	×	×	×	×	×	×	...	×	...	...	...	×	Probably resident.
Temenuchus pagodarum ...	×	×	×	×	×	×	×	×	×	×	×	×	
Acridotheres tristis ...	×	×	×	×	×	×	×	×	×	×	×	×	
Ploceus philippinus ...	...	...	×	...	...	...	...	...	...	...	...	...	Not a typical resident.
Uroloncha malabarica ...	×	×	×	×	×	×	×	×	×	×	×	×	
Stictospiza formosa ...	...	...	...	...	×	...	...	...	...	...	...	...	Local.
Carpodacus erythrinus ...	...	×	...	a	a	a	a	a	a	a	...	...	Migratory.
Gymnorhis xanthocollis ...	×	×	×	×	×	...	...	...	...	...	...	×	Suspected migrant.
Passer domesticus ...	×	×	×	×	×	×	×	×	×	×	×	×	
Emberiza melanocephala ..	...	×	×	...	...	...	...	...	...	...	...	...	Migrant.
Emberiza icterica ..	...	...	×	..	..	...	...	...	...	...	...	...	Do.
Melophus lathami ...	...	×	×	×	×	×	...	...	...	...	...	...	Status uncertain.
Riparia chinensis ...	...	...	...	...	×	×	×	...	...	...	...	...	Probably resident.
Riparia concolor ...	...	...	...	...	×	×	...	...	...	...	...	...	
Hirundo smithii ...	×	×	×	...	×	×	×	×	×	...	...	×	
Hirundo daurica ...	...	...	...	...	×	...	...	...	...	...	...	...	Local.
Motacilla alba ...	×	×	×	×	a	a	a	a	a	×	×	×	
Motacilla maderaspatensis.	×	..	×	×	...	...	...	×	...	...	...	×	Resident.
Motacilla cinerea ...	×	×	×	×	a	a	a	a	×	×	×	×	
Motacilla flava ...	...	...	×	...	...	...	...	...	...	...	...	...	Migratory.
Anthus hodgsoni ...	×	...	×	×	a	a	a	a	...	...	...	×	Absent in Summer.

MONTHLY LIST OF BIRDS OBSERVED—(*continued*).

× shews bird seen. a shews bird definitely absent.

Species.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Remarks.
Anthus rufulus ...	...	...	...	×	...	×	×	×	×	...	...	...	Status uncertain.
Alauda gulgula ...	...	...	...	...	×	×	×	...	...	...	...	...	
Mirafra sp. ...	...	×	...	...	...	...	...	...	...	...	...	...	Insufficient data.
Ammomanes phoenicura ...	...	...	...	×	...	...	...	...	...	...	...	...	Do.
Eremopteryx grisea ...	...	×	×	×	×	...	...	...	...	...	...	...	Probably migratory.
Zosterops palpebrosa ...	×	...	...	×	×	×	×	×	×	...	...	×	
Cinnyris asiaticus ...	×	×	×	×	×	×	×	×	...	...	...	×	
Pitta brachyura ...	a	a	a	...	×	...	...	...	×	...	a	a	Summer visitor.
Dryobates mahrattensis ...	×	×	×	×	×	×	...	...	...	...		×	Resident.
Dryobates hardwickii ...	...	×	...	×	×	...	...	...	...	...	...	...	Resident local.
Brachypternus bengalensis...	×	×	×	×	×	...	×	×	×	...	...	×	
Thereiceryx zeylanicus ...	×	×	×	×	×	...	...	×	×	...	...	×	
Xantholaema haemacephala.	×	×	×	×	×	×	×	...	...	...	...	×	
Coracias bengalensis ...	×	×	×	×	×	×	×	×	×	...	...	×	
Merops orientalis ...	×	×	×	×	×	×	a	a	×	...	...	×	Locally migrates.
Ceryle rudis ...	×	×	×	×	×	...	...	...	...	...	...	×	Resident.
Alcedo atthis ...	×	×	×	×	×	...	×	...	...	...	...	×	Do.
Ramphalcyon capensis ...	×	×	×	×	...	...	...	...	...	...	...	×	Do.
Halcyon smyrnensis ...	×	×	×	×	×	×	×	×	×	...	...	×	Do.
Tockus birostris ...	×		×	×	×	×	×	×	×	...	...	×	Do.
Anthracoceros coronatus ...	...	...	...	...	...	...	...	...	...	...	...	×	Blanford and Dazes.
Upupa epops ...	×	×	×	×	×	×	×	...	...	...	...	×	Rare local migrant.
Micropus affinis ...	×	...	×	×	×	×	...	...	...	...	...	×	Resident.
Micropus melba ...	...	...	×	...	...	...	...	...	...	...		...	
Hemiprocne coronata ...	...	..	×	×	×	...	...	...	...	...	...	...	Resident.
Caprimulgus macrurus ...	...	...	...	×	×	...	...	...	...	...	...	...	Only recorded by breeding calls

MONTHLY LIST OF BIRDS OBSERVED—(*continued*)

× shews bird seen. a shews bird definitely absent.

Species.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Remarks.
Caprimulgus indicus	...	...	...	×	×	...	...	..	...	...	...	...	Do.
Caprimulgus asiaticus	...	...	...	×	×	...	...	...	...	...	...	...	Do.
Cuculus canorus	a	a	a	×	×	×	×	×	...	a	a	a	
Cuculus micropterus	a	a	a	×	×	×	×	a	a	a	a	a	
Hierococcyx varius	×	×	×	×	×	×	×	×	×	...	..	×	Probably resident.
Clamator jacobinus	a	a	a	a	a	×	×	×	×	a	a	a	
Eudynamis scolopaceus	a	a	×	×	×	×	×	×	a	a	a	a	
Toccocua leschenaultii	...	×	×	×	×	...	...	...	...	...	...	...	Probably resident.
Centropus sinensis	×	×	×	×	×	×	×	×	×	...	...	×	
Psittacula eupatria	×	×	×	×	×	×	×	×	×	...	...	×	
Psittacula krameri	×	×	×	×	×	×	×	×	×	...	..	×	
Psittacula cyanocephala	×	×	×	×	×	×	×	×	×	..	...	×	
Ketupa zeylonensis	×	...	...	...	...	...	...	...	...	...	...	...	Insufficient data.
Bubo bengalensis	...	...	×	×	...	...	...	...	...	...	...	...	Do.
Otus sunia	×	×	×	×	×	...	...	...	...	...	×	×	
Athene brama	×	×	×	×	×	×	...	...	...	...	...	×	
Sarco gyps calvus	×	...	×	×	×	×	×	×	×	...	...	×	
Gyps indicus	...	...	...	...	×	...	...	...	...	...	...	...	Probably resident.
Pseudogyps bengalensis	×	×	×	×	×	×	×	×	×	...	...	×	
Neophron percnopterus	×	×	×	×	×	×	×	×	×	...	...	×	
Spizaetus cirrhatus	×	...	×	...	×	...	...	...	...	...	...	×	
Spilornis cheela	...	...	×	×	×	...	...	...	...	...	...	...	Local.
Butastur teesa	×	×	×	×	×	×	...	...	...	...	...	×	
Haliastur indus	×	×	×	...	×	×	...	...	...	...	...	×	
Milvus migrans	×	×	×	×	×	×	×	×	×	...	...	×	
Circus macrourus	×	×	×	a	a	a	a	a	a	×	×	×	

MONTHLY LIST OF BIRDS OBSERVED—(*continued*).

× shews bird seen. a shews bird definitely absent.

Species.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Remarks.
Astur badius ...	×	×	×	...	×	×	...	...	...	...	...	×	Resident.
Falco tinnunculus ...	×	×	×	×	...	...	...	...	...	...	...	×	Probably migratory.
Elanus coerulens ...	...	×	...	×	×	...	...	...	...	...	...	...	Probably resident.
Crocopus phoenicopterus ...	×	×	×	×	×	×	×	×	×	×	×	×	
Columba livia ...	×	×	×	×	×	×	×	×	×	×	×	×	
Streptopelia orientalis ...	×	×	×	×	×	×	×	×	×	×	×	×	
Streptopelia chinensis ...	×	×	×	×	×	×	×	×	×	×	×	×	
Streptopelia senegalensis ...	×	×	×	×	×	×	×	×	×	...	...	×	
Streptopelia risoria ...	×	×	×	×	×	×	×	×	×	×	×	×	
Oenopopelia tranquebarica.	×	×	×	×	×	×	×	...	...	...	...	×	Partially migratory.
Pterocles indicus ...	×	×	×	×	×	×	×	×	×	×	×	×	
Pavo cristatus ...	×	×	×	×	×	×	×	×	×	×	×	×	
Gallus sonnerati ...	×	×	×	×	×	×	×	×	×	×	×	×	
Galloperdix spadicea ...	×	×	×	×	×	×	×	×	×	×	×	×	
Coturnix coturnix ...	×	×	×	×	×	×	×	×	×	×	×	×	
Perdicula asiatica ...	×	×	×	×	×	×	×	×	×	×	×	×	
Francolinus pondicerianus.	×	×	×	×	×	×	×	×	×	×	×	×	
Francolinus pictus ...	×	×	×	×	×	×	×	×	×	×	×	×	
Oedicnemus oedicnemus ...	...	...	...	×	...	...	...	...	...	...	...	...	Local.
Lobivanellus indicus ...	×	×	×	×	×	×	×	×	×	×	×	×	
Lobipluvia malabarica ...	×	×	×	×	×	×	×	×	×	×	×	×	
Charadrius dubius ...	...	...	×	×	...	...	...	...	...	...	...	...	Status uncertain.
Hoplopterus duvaucellii ...	...	...	...	×	×	...	...	...	...	...	...	...	Probably resident.
Tringa hypoleucus ...	×	...	×	×	...	...	...	...	...	...	...	×	
Phalacrocorax niger ...	...	...	...	×	...	×	...	...	...	...	...	...	Resident.
Pseudibis papillosus ...	...	...	×	...	...	...	...	...	...	...	...	...	Local.

MONTHLY LIST OF BIRDS OBSERVED—(*continued*)

× shews bird seen. a shews bird definitely absent.

Species.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Remarks.
Dissoura episcopus	...	×	×	×	×	...	...	...	...	...	...	...	Local.
Bubulcus ibis	×	...	...	×	×	...	...	...	...	...	...	×	Local.
Ardeola grayi	...	...	...	×	...	×	...	...	...	...	...	...	Local.
Butorides striata	...	...	×	×	×	...	...	...	...	...	...	...	Local.

THE EARLY STAGES OF INDIAN LEPIDOPTERA.

BY

D. G. SEVASTOPULO, F.R.E.S.

PART IV.

(*Continued from page* 81 *of this volume*).

RHOPALOCERA.

PAPILIONIDÆ.

Papilio demoleus L., *demoleus*.
Moore, *Cat. Lep. Mus. E.I.C.*, i, 105, pl. 3, figs. 6, 6a. 1857.
Moore, *Lep. Ceyl.*, i, 147, pl. 61, figs. 2a, 2b. 1880-81.
Moore, *Lep. Ind.*, v, 234, pl. 466, figs. 1, 1a. 1901-03.
Bingham, *Fauna Brit. Ind.*, Butterflies, ii, 40. 1907.

Head pale brown. Ground colour deep green, a narrow white sublateral stripe from the 5th to 12th somite, which latter, together with the anal flap and claspers, is greyish white. 1st somite with a pair of small brown subdorsal points. 11th somite with a pair of small brown subdorsal spines. 3rd and 4th somites somewhat swollen. 3rd somite anteriorly with a small lateral ocellus consisting of a black spot edged below with white and above with fawn, the two ocelli joined by a narrow transverse dorsal stripe of black-ringed fawn spots interspersed with white streaks. The skin between the 2nd and 3rd somites grey; that between the 4th and 5th velvety black but only exposed when the larva is extended. The 4th somite posteriorly with a narrow fawn transverse stripe with an irregular anterior edge. Spiracles black. Legs pale brown. Prolegs and venter greenish white. Osmeterium deep orange shading into red at the apex. In some larvae there is a greyish white oblique lateral stripe on the 7th somite joining the sublateral stripe, and this is sometimes continued subdorsally on the 8th somite. One example had particularly dark markings, the skin between the 2nd and 3rd somites being blackish, with sublateral blackish shading on the 1st to 3rd somites, an oblique blackish subdorsal stripe from the 8th somite joining the sublateral stripe on the 7th, a blackish lateral blotch on the 9th somite, the 11th and 12th somites marked with blackish and with black subdorsal spots on the 9th, 10th and 11th somites, head and legs redder brown.

Pupa with head obtuse, slightly bifid. Thorax keeled and rising to a small point directed forwards. Abdomen slightly dilated across the 3rd somite. 4th to 6th abdominal somites with very short subdorsal tubercles, almost obsolete in the green forms. Two colour forms. The one bright green, a transverse yellow line behind the head, another along the keel of the thorax and continued along the abdomen just above the edge of the wing case and a double yellow line dorsally on the first three abdominal somites, a whitish subspiracular stripe along the abdomen and then along the upper edge of the wing case. The other form varying from pale to dark greyish brown, some examples with a distinct pink tinge. The head, prothorax, a dorsal stripe on the first four abdominal somites and the central area of the wing cases considerably darker than the rest. A whitish streak on the upper edge of the wing case. Supported by a girdle and tail pad of whitish silk. The colour of the pupa is said to vary with its surroundings but, out of four pupae formed on the sides of a black gauze cage, two were green, one blackish brown and one greyish brown.

Food-plant—*Citrus* spp.

Described from a full fed larva found in Calcutta 27-vii-39, pupated 29-vii-39, and a male emerged 8-viii-39.

Moore's description in *The Lepidoptera of Ceylon* is 'Larva cylindrical, thickest anteriorly; green, with pale yellow lower lateral line, head and legs; a dark-bordered yellow dorsal band on edge of fourth segment; and another ending in a lateral ocellated spot on third segment, a pale lateral streak obliquely ascending eight and ninth segments, and an irregular upright streak on tenth segment, a pair of short pointed tubercles on front and anal segment. Pupa green.' Bingham writes 'Full grown the larva is brilliant rich green, velvety and without tubercles, the sides and some of the segments dorsally marked with black, yellowish white, and rich brown; head, legs and prolegs reddish brown. The food-plant varies, the 'bael' (*Aegle*), 'ber' (*Zizyphus*), lime, orange and pumelo are the chief. Pupa green or yellowish brown according to surroundings.'

NYMPHALIDÆ.

Ergolis merione Cr., *tapestrina* Moore.

Sevastopulo, *J.B.N.H.S.*, xli, 72. 1939.

A third form is green with a yellowish white double dorsal stripe bordered with dark brown on the 3rd, 6th and 10th somites, and with a subdorsal olive green stripe. When fully fed, but before the colour change prior to pupation, the dorsal stripe becomes pale green.

A fourth form has a yellowish dorsal stripe with a red brown median line and subdorsal brown stripe, this latter darker on the 3rd, 6th and 10th somites. The subdorsal series of spinous tubercles brown.

Pupa also variable. In addition to the previously described purplish brown form, there is a form with the wing cases, sides of the thorax and the front of the abdominal prominence green; the edges of the wing cases, the thoracic keel and the abdominal somites pinkish. Another has the wing cases, sides of the thorax and the front of the abdominal prominence tinged with olive green, the rest purplish brown. A wild caught pupa was bright green with the tips of the cephalic horns, the thoracic keel and the edge of the wing cases on the thorax and abdomen buff, 3rd and 4th abdominal somites dull dark brown, the heart shaped mark black and a smoky black subdorsal streak along the abdomen. The heart shaped mark on the 5th abdominal somite and the reticulated pattern of the wing cases is present in all forms.

Described from a number of full fed larvae found in Calcutta, one of which pupated 29-vii-39, and a male emerged 6-viii-39.

HETEROCERA.

ARCTIIDÆ.

Aganais ficus F.

Sevastopulo, *J.B.N.H.S.*, xl, 401. 1938.

Ovum—Smooth, spherical, the base flattened. When first laid pale yellow, after twenty-four hours becoming minutely streaked and speckled with dark red. Laid in small batches but not touching each other. Hatched on the third day.

LYMANTRIIDÆ.

Euproctis guttata Wlk.

Hamps., *Fauna Brit. Ind.*, Moths, i, 477. 1892.

Strand Seitz, *Indo-Austr. Bombyces*, x, 343.

Ova pale greenish yellow, slightly flattened spheres with the micropylar area depressed. Laid in batches covered with hair from the anal tuft of the female. Hatched on the seventh day.

Larva—Head brown. Body black. 1st somite with a brown dorsal blotch and with subdorsal black tubercles tufted with longish black hair. 2nd and 3rd somites each with a transverse series of four brown warts, a lateral black and a sublateral brown wart, all tufted with moderately long grey hair. 4th and 5th somites each with two large red-brown dorsal warts tufted with very short brown hair, and a brown lateral and sublateral wart tufted with longish grey hair. 6th to 12th somites with a subdorsal, lateral and sublateral series of brown warts tufted with grey hair, that of the sublateral series and of the warts on the 12th somite being longest. 6th to 9th somites with an additional wart at the base of each proleg. Eversible dorsal glands on the 9th and 10th somites whitish. A subdorsal yellow slit-like streak immediately behind the warts on the 10th and 11th somites. Legs and prolegs brownish.

Pupa in a cocoon of brown silk mixed with larval hairs. Olive green, the dorsum tinged with brown. Slightly hairy. Head obtuse.

Food-plant—*Lagerstroemia indica* Linn.

Described from one of a number of full fed larvae bred from ova in Calcutta, pupated 10-viii-39, and a male emerged 21-viii-39.

Hampson's description, which is more or less copied in Seitz, is 'black, the head chestnut; long anterior and short lateral tufts of grey hair; the thoracic somites with dorsal grey tufts; the others with dorsal tufts of short brown hair.'

LASIOCAMPIDÆ.

Trabala vishnu Lef.

Moore, *Lep. Mus. E.I. Co.*, pl. 22, figs. 3, 3b. 1857-59.
Moore, *Lep. Ceyl.*, ii, 146, pl. 138, figs. 1b, 2a. 1882-83.
Hamps., *Fauna Brit. Ind.*, Moths, i, 422. 1892.

Ova slightly oblong, very pale cream. Laid in a double row and covered with hairs from the anal tuft of the female. Hatched 24-iv-39.

1st instar—Head red brown. Body yellow green with eleven transverse black bands. 1st somite with very slight subdorsal pencils of dark hair arising from dark warts. Body with sparse white hairs. Legs black. Claspers pink. Gregarious. Moulted 28-iv-39.

2nd instar—Similar but head crimson with two vertical yellow stripes. The subdorsal tufts on the 1st somite larger. Moulted 1-v-39.

3rd instar—Similar to preceding but more hairy. The black transverse bands each with four blue hairy spots. Moulted 5-v-39. Ceases to be gregarious.

4th instar—Very like the final but less hairy so that the yellowish ground colour is visible and the blue spots more pronounced. Moulted 9-v-39.

5th instar—Similar to final. Moulted 13-v-39.

Final instar—Head crimson with two vertical narrow yellow stripes and a fine network of vertical and horizontal yellow lines. 1st somite with subdorsal warts giving rise to long pencils of dark brown hair, giving the larva the appearance of a Lymantriid. Body thickly clothed with dense whitish fur, developing dorsally and laterally into tufts, intermixed with stouter, sharp black hairs. Just prior to pupation the fur becomes bright yellow. 2nd to 12th somites each with a pair of dull blue subdorsal spots giving rise to a few coarse black hairs. A lateral series of similar spots almost hidden by the fur of the body. Legs and prolegs pink marked with yellow. Venter yellow blotched with pink. Spun 18-v-39. Pupated 20-v-39.

Pupa smooth and shining, pale reddish brown with the venter and wing cases yellowish. Not very highly chitinised. Meta thorax with a pair of raised crescent-shaped black marks. Cremaster a cluster of minute hooked hairs. Spiracles darker brown. In a cocoon of thick felted yellowish silk, into which the short black, and extremely irritating, larval hairs are worked. Boat-shaped with a dorsal hump at each end and a slit at the front and back, the cast larval skin being ejected through the hinder one and the imago emerging through the front. When spun on a thin stalk or twig, there is a barrier of silk and hairs on each side of the cocoon itself. A male emerged 31-v-39.

Food-plant—In Calcutta usually on Castor (*Ricinus communis* Linn.), but also on *Quisqualis indica* Linn. and *Lagerstroemia Flosreginae* Retz. In Shillong on *Rubus* sp. and in Murree on *Rosa* sp. Moore gives *Terminalia* and *Eugenia* in Ceylon.

Described from larvæ bred from ova found in Calcutta.

Moore describes the larva as 'olive-brown or pinkish-brown; with a subdorsal and lateral row of black tubercular spots, from which radiate a tuft of black hairs; a dorsal tuft of radiating black hairs, and an intervening conical tuft of pale pinkish hairs, a lateral row of decumbent tufts of pale pink hairs, and a projecting tuft of long hairs on each side of the head; a black dorsal collar on front of second segment; head with red spots; legs red. Cocoon pale olivaceous or pinkish-brown, protuberant laterally on one side at each end. Pupa brownish-red.' Hampson writes 'Head yellow, spotted with red; the colour brownish grey, with long lateral tufts on each somite; that on the first black and grey, the others grey; paired dorsal and lateral black spots on each somite, from which spring long black hairs, the spots on the thoracic somites coalescing.' Another form of the larva is blackish with a broad white dorsal stripe, the anterior tufts red-brown; a third form is reddish with the lateral spots blue. Cocoon ochreous, with short black hairs projecting from it, which are intensely irritating.

SPHINGIDÆ.

Cephonodes hylas L., *hylas*.

Moore, *Lep. Ceyl.*, ii, 31, pl. 93, fig. 4b. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, i, 121. 1892.

Seitz Seitz, *Indo-Austr. Bombyces*, x, 544.

Bell & Scott, *Fauna Brit. Ind.*, Moths, v, 249, pl. 3, figs. 8 and 9. 1937.

Ovum—Pale bright green. Laid singly on the upper or lower surface of a leaf of the food-plant. Hatched 6-ii-39.

1st instar—Head round, greenish yellow. Body greenish yellow, clothed with very short forked hairs. Horn straight, long and black with the tip forked. Moulted 10-ii-39.

2nd instar—Head round, yellow green. Body somewhat bluer green, with or without a row of nine black lateral spots. OR the body greyish with a row of nine black lateral spots; the legs blackish; 1st somite and anal claspers yellowish green. In both forms the horn is straight and black with the tip bifid. Moulted 13-ii-39.

3rd instar—Head round, green. 1st somite yellowish green, swollen and tuberculate; body green with a white subdorsal stripe, below which is a series of nine, or ten, round, or pear-shaped, black spots; legs and prolegs green. OR with blackish legs. OR with the secondary segmental lines black; the spiracles set in orange blotches; the legs black; the prolegs marked with black. OR with the ground colour of the body smoky black. In the dark forms the head and first somite are yellowish olive. Horn in all forms straight and black, the tip bifid. Moulted 16-ii-39.

4th instar—Head round. 1st somite swollen with small yellow tubercles. Head and body green, a white subdorsal stripe, below which is a series of ten round black spots; legs and prolegs reddish; spiracles orange ringed, the posterior one set in an orange patch.

OR head and 1st somite yellowish olive; body grey with black transverse lines, a white subdorsal stripe edged below with black, below which is a series of ten wedge-shaped black spots; spiracles set in orange patches; legs black; prolegs and anal claspers olive tinged with orange. OR with the head and 1st somite orange brown; body dark chocolate brown, the subdorsal line obsolescent; legs, prolegs and the ring round the spiracles dark golden brown. OR with head and 1st somite green; body grey green with an indistinct smoky black dorsal stripe, a white subdorsal line edged below with black, beneath which is a series of ten wedge-shaped black spots; spiracles set in yellow patches; legs blackish; prolegs and anal claspers blackish tinged with olive. In all forms the spiracles are white with an orange transverse bar and the horn is long, upcurved, black with the sides and under surface of the basal two-thirds whitish, tuberculate and the tip pointed. Moulted 20-ii-39.

Final instar—Head round. 1st somite swollen, both it and the anal flap with minute yellow tubercles. Head and 1st somite green; body green with a white subdorsal stripe, edged below with short black streaks along the secondary segmental lines, and with a series of ten wedge-shaped black lateral spots; spiracles ringed with orange, the last set in an orange blotch; legs and prolegs reddish; venter blackish, the ventral and lateral areas separated by a broken black stripe. OR with head and 1st somite olive green; a broad black dorsal stripe from 2nd somite to base of horn edged with yellowish; a white subdorsal stripe edged above by a series of short black streaks along the secondary segmental lines and below by a black stripe from which a tooth runs downward onto each somite; lateral area greenish yellow; legs purple; prolegs brownish with the base black; anal flap olive green; venter blackish; spiracles set in orange blotches; an orange spot on each side of the base of the horn. OR with head and 1st somite pale olive green; body with the dorsal area pinkish, a white subdorsal stripe edged below with a series of short black streaks along the secondary segmental lines, these streaks almost obliterating the usual lateral series of black spots except on the 2nd and 3rd somites; lateral area greenish yellow; spiracles ringed with orange, the posterior one in an orange blotch; a short black streak from immediately in front of the base of the horn to the subdorsal white stripe; legs and prolegs purplish, the base black; anal somite pale olive green; venter pinkish with a blackish lateral stripe. OR with head and 1st somite green; body green with a white subdorsal stripe, edged above with a crimson line, below which is a series of nine small round black spots; a short black streak immediately in front of and above the posterior spiracle; spiracles ringed with orange, the last one set in an orange blotch; legs and prolegs purplish; venter green with a lateral purplish stripe edged above with a broken black stripe. In all forms the spiracles are white with a transverse orange bar and the horn is black, slightly tuberculate, of medium length and curved slightly downward. Pupated 1-iii-39.

A few larvae undergo a fifth ecdysis but there is very little change in size and none in appearance between the 5th and 6th instars. A peculiar feature in this species is that larvae, which assume the greyish coloration in the early instars, may revert to the green form in the final.

The above descriptions apply to larvae reared in captivity. Wild larvae are more constant, in the early instars green with the 1st somite and anal flap with minute yellow tubercles, a narrow yellowish white subdorsal stripe after the 3rd instar. Full grown larva with head and body green; 1st somite and anal flap with minute yellow tubercles; a bluish white dorsal stripe with a bluish green median stripe from 3rd somite to base of horn; a narrow white subdorsal stripe edged above with carmine and joining the base of the horn; immediately beneath this stripe there is sometimes a series of nine small black dots; horn green with a few small black tubercles; legs and prolegs green; spiracles white with an orange transverse bar; venter green.

Pupa in a slight cocoon among litter on the surface of the ground. Rather slender, dark chestnut brown with a darker dorsal stripe on the abdominal somites. A female emerged 14-iii-39.

Food-plant—Gardenia.

Described from larvae bred from ova and found in various instars in Calcutta.

Bell and Scott give the orange bar to the spiracles as an absolute distinction between this species and the closely allied *C. picus* Cr. This is not so, however, as I have bred *hylas* from a larva with unbarred spiracles and I have a preserved specimen in which some of the spiracles are barred and others not. Moore's description is:—'Early stage—Pale bluish-green; second segment yellow dotted; a subdorsal black-dotted duplex line; a lateral row of black transverse spots; spiracles and abdominal line, and legs brownish-ochreous; head blue-green; horn with black granular dots. Adult—Brighter green, with a white-bordered blue dorsal line, and whitish subdorsal line ending in a yellow streak at base of horn; head and spiracles blue. Pupa pale violet brown.' This description is followed by Hampson. Seitz writes: '. . . the larvae vary a great deal both locally and individually; they may be green, yellow, or red, sometimes with blackish, orange spotted sides, or the larva is green with yellow sides and a blue dorsal band; on Rubiaceae, particularly Gardenia, Adina, and Randia in China (in Africa also on Kraussia lanceolata). The pupa has the approximate shape of that of *Celer. euphorbiae*, but it is dark brown with lighter segmental folds.' He adds a footnote 'Fawcett, in *Trans. Ent. Zool. Soc. Lond.*, xv, pl. 48, figures five differently coloured types of the larva of *hylas*.'

PSYCHIDÆ.

Chalioides vitrea Hamps.

Head red brown with two small inverted yellow V-shaped marks just above the mandibles and a double median yellow line. Thoracic somites red brown, the skin between the somites and also between the 1st somite and the head yellow. A yellow dorsal and subdorsal stripe. Abdominal somites slightly chitinised and greyish pink in colour. 12th somite, anal flap and anal claspers more heavily chitinised and red brown in colour. Prolegs very small. Legs increasing in size from 1st to 3rd pairs, brown.

Case of greyish silk, a tapering cylinder, broadest at the top, not unlike an Indian 'biri' in shape. I have one case in which the imago has escaped from the top.

Food-plant—*Grewia hirsuta* Vahl.

Described from a full fed larva from one of a number of cases found in Calcutta 31-v-39, from another of which a male emerged 18-vi-39.

Clania cramerii Westw.

Moore, *Lep. Ceyl.*, ii, 102, pl. 118, fig. 1a. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, i, 291, fig. 198. 1892.

Gaede Seitz, *Indo-Austr. Bombyces*, x, 738.

Head dark brown, speckled with pale brown and with a double pale brown stripe from above clypeus to vertex. Thoracic somites very dark brown with a sublateral and subdorsal stripe starting from the anterior edge of the 1st somite and a dorsal stripe starting from the centre of the 1st somite. Abdominal somites with the skin very slightly chitinised, dark grey in colour, the sides and venter paler. Abdominal prolegs very small. Anal claspers, anal flap and 12th somite more heavily chitinised and blackish in colour. Legs brown marked with paler, increasing in size from 1st to 3rd pairs.

Male pupa reddish brown; the thorax shining, the abdomen dull. Long and slender in shape, the last two somites curved downwards. Cremaster two conical projections. 10th, 11th and 12th somites with a transverse dorsal row of backward pointing teeth. A slight keel on the head between the eyes. Female pupa rather paler in colour, like a chitinised maggot, without wing cases, leg or antenna sheaths, the posterior end somewhat swollen and without dorsal teeth. The head and thoracic somites paler in colour than the abdomen. Before pupating the larva attaches the top of the case firmly to some support and then turns round, pupating head downwards, and the male imago escapes from the lower end leaving the pupal shell in the exit.

Case cylindrical, covered with longitudinally arranged twigs, the ends of which are even at the front but very irregular at the hinder end of the case.

Food-plant—Various. I have bred it on *Lagerstroemia indica* Linn. and *Alseodaphne semicarpifolia* Nees.

Described from a number of larvae found in Calcutta 3-v-39, from one of which a male emerged 15-v-39.

Hampson's figure shews the larva protruding from its case, but all the descriptions and Moore's figure are of the case only. Moore's description is the fullest and he states that the case is 'covered with slender twigs of irregular length, which are disposed longitudinally side by side in a somewhat spiral form.'

NOCTUIDÆ.

Agrotis spinifera Hbn. (*biconica* Koll.).

Mill., *Ann. Soc. Lyon*, (2) xix, 41, pl. 112, figs. 1, 2. 1872.

Ovum—Bluish white, round with numerous ribs running from the micropyle to the base. Laid, in captivity, in lines on the blades of grass. Hatched on third day.

Full grown larva—Head pale brown with a dark brown H-shaped mark. Ground colour greyish brown, the thoracic plate darker and the dorsum tinged with pinkish. A blackish dorsal and subdorsal stripe, below which there are two whitish lines. Sublateral and ventral areas greenish white. The abdominal somites each with two black dots between the dorsal and subdorsal stripes, the thoracic somites with one dot between and one on the subdorsal stripe. Spiracles black and conspicuous. Legs very pale brown. Claspers whitish green and very small.

Pupa subterranean in a slight earthen cocoon. Yellowish brown, the intersegmental area slightly darker and with a darker dorsal stripe on the abdominal somites. A dark spot on each side of the pro-thorax. Cremaster ending in two sharp pointed spines.

Food-plant—Grasses. The larvae feed at night, concealing themselves during the day.

Described from a number of full fed larvae bred from ova in Calcutta, one of which pupated 7-vii-39 and a female emerged 18-vii-39.

Hampson in the *Catalogue of the Lepidoptera Phaleanae*, iv, quotes the description referred to above as follows:—'Greenish-grey; the dorsum ochreous; dorsal line double brown; subdorsal line dark; supra- and substigmal lines whitish with dark edges; head and thoracic shield ochreous. Food-plant, grasses.' This description was presumably made from a French larva.

Achaea (*Ophiusa*) *melicerte* Drury.

Moore, *Lep. Ceyl.*, iii, 164, pl. 168, fig. 2b. 1884-87.

Hamps., *Fauna Brit. Ind.*, Moths, ii, 495. 1894.

Hamps., *Cat. Lep. Phal.*, xii, 537. 1913.

Gaede Seitz, *Indo-Austr. Noctuidae*, xi, 481.

Head dark olive brown with a few black hairs; clypeus with a carmine V-shaped mark, and outlined by a narrow cream coloured stripe; the sides of the head and two small triangular streaks from the vertex, which do not quite reach the clypeus, cream, these streaks divided into two by a bar of the ground colour. True ground colour of the body whitish, the apparent colour due to a dense sprinkling of minute dots. A broad blackish dorsal and sublateral stripe, the area between slightly paler and edged above and below by a stripe consisting of minute orange dots. An interrupted double orange dorsal line, which joins and divides forming a chain-like pattern, and an orange subspiracular line. The 4th somite posteriorly with a solid black transverse band. A double dorsal and a subdorsal yellowish spot on the anterior edge of the 5th somite. 2nd to 11th somites each with a pale ringed black lateral spot. 11th somite with a pair of dorsal crimson tubercles. 12th somite with a pair of small black dorsal spots. Spiracles orange red. Legs orange. Prolegs marked externally with white and with a white spot just above the base, the first pair obsolescent. Venter pinkish sprinkled with minute grey dots, a faint blackish median stripe expanding into a black spot between each pair of legs and prolegs and also on the 10th somite. A narrow cream stripe, edged on each side with black, dividing the ventral and sublateral areas.

Pupa in a thin cocoon in a spun together leaf. Purplish brown, so densely covered with a white bloom that the true colour is only visible between the abdominal somites.

Food-plant—Castor (*Ricinus communis* Linn.).

Described from a full fed larva found in Calcutta 24-ii-39, pupated 27-ii-39, and a female emerged 9-iii-39.

Moore's description, which is largely copied by Hampson in the *Fauna*, is :—'Adult larva elongated, slender, half-looped; with sixteen legs, the first pair of middle legs aborted; two dorsal red tubercles on twelfth segment; colour bluish-grey, numerously speckled with bluish-black; a lateral and sublateral yellowish band, with an intervening bluish-grey line; spiracles and forelegs red; a dorsal black stripe bordered by reddish-white spots between fifth and sixth segments; head black striped. Pupa formed within a leaf.' Hampson in the *Catalogue* writes :—'Larva bluish grey speckled with blue-black or black-brown; lateral and sublateral yellowish stripes with a blue-grey line between them; a dorsal black stripe edged with reddish white spots between 4th and 5th somites; a pair of dorsal red tubercles on anal somite; spiracles and fore legs red; head striped with black; the 1st pair of claspers aborted. Pupa rolled in a leaf.' This latter description forms the basis for that in Seitz.

PYRALIDÆ.

Dichocrocis punctiferalis Guen.

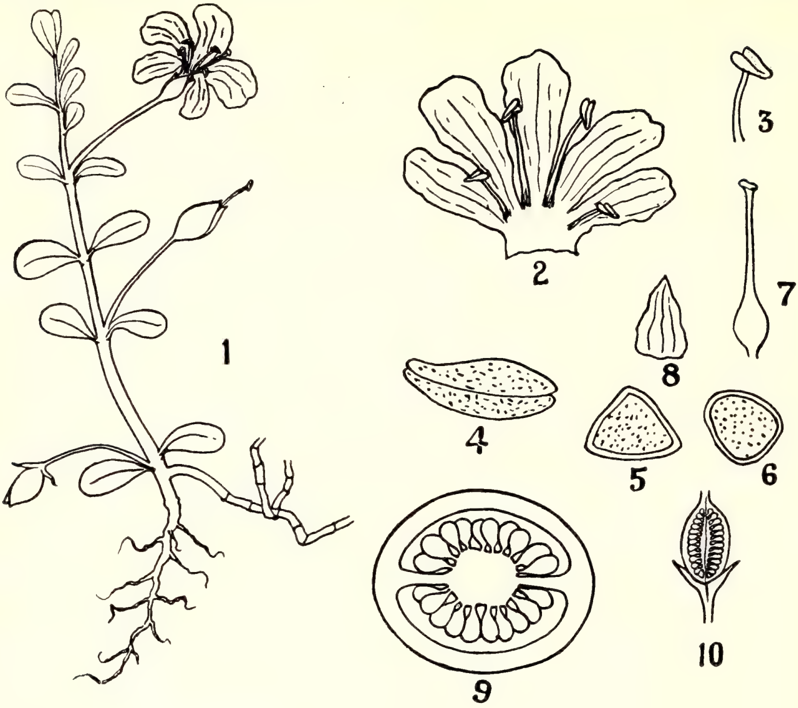
Head and thoracic plate red brown. Ground colour dirty whitish grey, slightly tinged with pinkish. Each somite with two pairs of ovoid dorsal spots, a round lateral and two round sublateral spots of a dark olive colour. A white spiracular line. A few white hairs. Legs and prolegs of the ground colour.

Pupa in a slight cocoon of thin white silk. Rather slender, with the leg sheaths projecting beyond the wing cases. Colour reddish brown, the thorax slightly darker and the ventral surface of the abdomen paler. Wing cases yellowish brown.

Food-plant—Castor (*Ricinus communis* Linn.), boring into the unripe capsules and eating the seeds.

Described from a full fed larva found in Calcutta 27-iii-39, pupated 30-iii-39, and a male emerged 7-iv-39.

(*To be continued*).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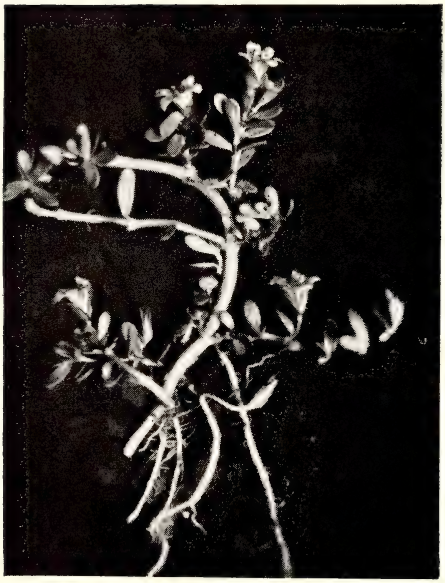

Sayeedud-Din—Common Indian Herbs.

(For explanation see end of article)

SOME COMMON INDIAN HERBS WITH NOTES ON THEIR ANATOMICAL CHARACTERS.

BY

M. Sayeedud-Din,

Prof. of Botany, Osmania University, Hyderabad Deccan.

(*With three plates*).

(*Continued from page* 115 *of volume* xli).

II.—Herpestis Monniera H.B. & K.

(SCROPHULARIACEÆ).

Synonymy and Systematic Description.

Herpestis Monniera H.B. & K., H.F.B.I., iv, 272; Benth. Scroph. Ind., 30; DC. Prodr., x, 410; Trim. Fl. Ceyl., iii, 246; Watt. Dict. Econ. Prod., iv, 225. Syns:—*Moniera cuneifolia* Michaux., Fl. Bor. Amer., v, 2 (1803), 22. *Herpestis spathulata* Blume., Bijd., 748, *Gratiola Monniera* Linn., Roxb. Cor., Pl. II, 41, and Fl. Ind. 47. *Bramia indica,* Lamk. Dict., i, 459.

A glabrous, rather succulent creeping herb, rooting at the nodes; branches numerous, ascending. Leaves entire, sessile, decussate, obovate-oblong or spathulate, fleshy, very obtuse; nerves obscure. Flowers axillary, solitary. Corolla pale-blue with shining dots when fresh. Anthers dark blue or blackish; pollen white; grains blackish and ellipsoidal when dry, and triangular or spherical and pale-yellow when moistened. Style dilated at the top and 2-lobed. Fruit an ovoid capsule (Plate I). Flowers practically all the year round. Root, stalk and leaves are medicinal. (For the properties refer to Watt, 7.)

Indian Names.

Brahmi, Manduki (Sans.); Brahmi, Jal-nim, Safed Chamni (Hind.); Adha-birni, dhop-chamni (Beng.); Bàm, nira-brahmi (Bomb.); nir-brami, beami (Tam.); Sambrani chettu (Tel.).

Habitat.

Common throughout India in damp places, and in all warm countries (recorded by the author in one of his previous papers, 5).

Anatomical Notes.

Structure of the leaf (Plate II). The fleshy leaves possess stomata on both sides which are, however, more numerous on the lower surface. They are of the Cruciferous type, and are surrounded by three or more epidermal cells. Chlorophyll grains are present in the epidermal cells. The mesophyll is composed of rounded, isodiametric cells, and shows no differentiation into palisade and spongy tissues. The feeble development of water-conducting elements is noteworthy, being related to the marshy habit. Oxalate of lime is excreted in the form of small octahedral or prismatic crystals. Glandular hairs occur on the epidermis, giving rise to transparent dots. They are provided with a very short stalk and a large peltate head, composed of 4-8 cells. They are different from any of those illustrated by Solereder (**6**), although he has recorded the occurrence of glands with peltate heads, composed of a considerable number of cells in *Gratiola, Capraria biflora* L., *Scoparia dulcis* L., *Herpestis gratioloides* Benth., *Calceolaria pinifolia* Cav. and *Russelia sarmentosa* Jacq.

Structure of the Stem (Plate III). The structure of the stem too, as that of the leaves, shows a marked adaptation to the marshy habit. Stomata are present quite in abundance. As in the case of the leaves here also oxalate of lime is excreted in the form of octahedral or prismatic crystals. The hairy covering consists of branched hairs resembling the candelabra hairs of other genera. The epidermal cells are thin-walled. There is a broad cortical region which is lacunar and consists of large more or less rounded cells. The innermost layer is formed by an endodermis. Xylem forms a small, closed cylinder. Individual vascular bundles are distinct, and are separated from one another by radial strips of prosenchymatous cells arranged in one or two rows. The pith consists of unlignified parenchymatous cells.

CONCLUSIONS.

The main features which may be taken as characteristic of this plant, are generally characteristic of the family Scrophulariaceae. For example, (**1**) excretion of oxalate of lime in the form of simple octahedral or prismatic crystals; (**2**) occurrence of cruciferous type of stomata, (**3**) absence of intraxylary phloem; (**4**) possession of glandular hairs with a short stalk and a large peltate head which is divided by vertical walls only into 4-8 cells, resembling the glandular hairs of the Oleaceae, with which they can be confused. But, since these are not allied families, other characters can be used to distinguish one from the other even in the sterile condition.

ACKNOWLEDGMENTS.

I am indebted to Mr. Sri Ram Loo for the drawings which were prepared under my supervision. Mr. M. Moinuddin helped me with the preparation of the slides for which I am thankful to him.

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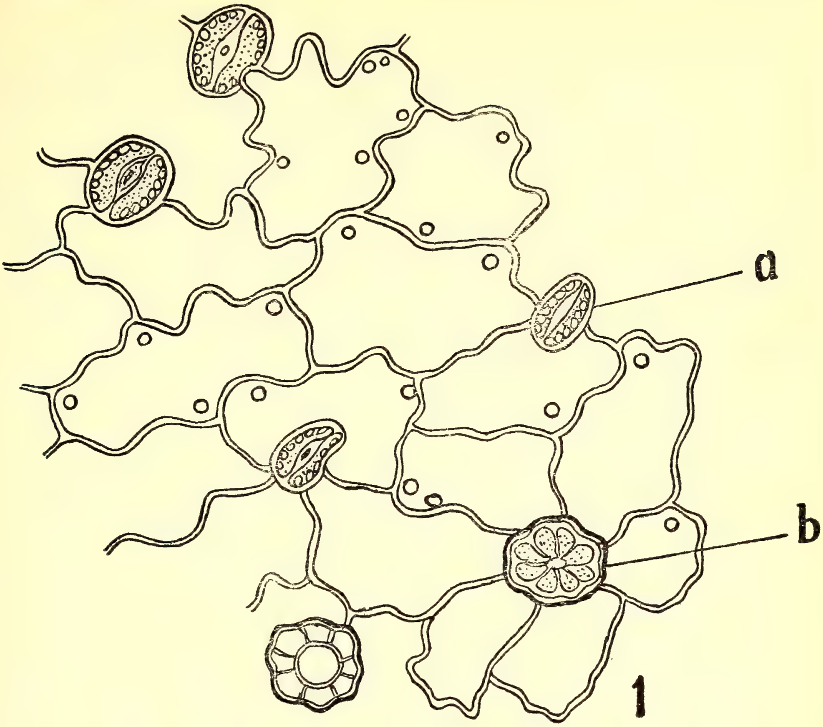

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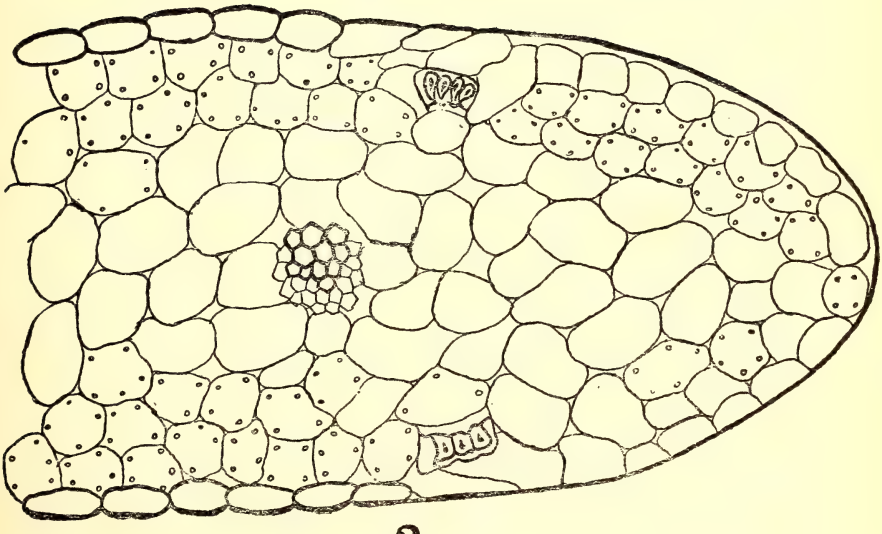

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Sayeedud-Din—Common Indian Herbs.

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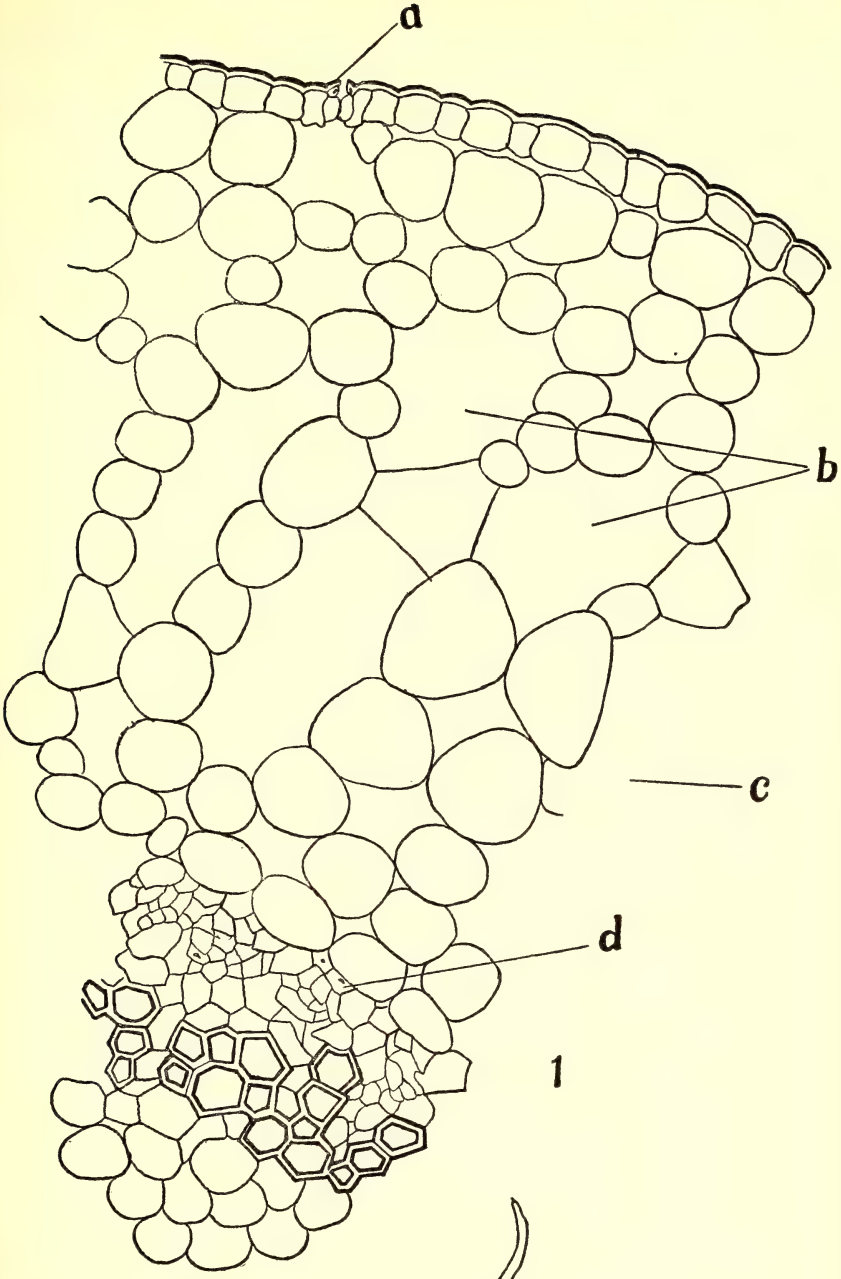

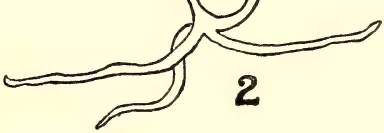

Sayeedud-Din—Common Indian Herbs.

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EXPLANATION OF PLATES I TO III.

Illustrating M. Sayeedud-Din's paper on 'Some Common Indian Herbs with notes on their Anatomical Characters.' II. *Herpestis Monniera* H.B. & K.

PLATE I.

Fig. 1.—Black and white sketch of *Herpestis Monniera* H.B. & K. (×2).
Fig. 2.—Corolla opened out, gynaeceum removed. (×5).
Fig. 3.—Stamen, showing the attachment of anthers. (×10).
Fig. 4.—Pollen grain much magnified, showing the shape in a dry condition. (×600).
Figs. 5 & 6.—Pollen grains much magnified, showing their shapes in a moistened condition. (×600).
Fig. 7.—Gynaeceum, showing ovary, style and 2-lobed stigma. (×5).
Fig. 8.—Fruit. (×2).
Fig. 9.—T.S. Ovary. (×100).
Fig. 10.—L.S. Ovary. (×10).
Fig. 11.—Photograph of *Herpestis Monniera* H.B. & K.

PLATE II.

Fig. 1.—Leaf-epidermis. (*a*), stoma; (*b*), glandular hair. (×100).
Fig. 2.—T.S. leaf, showing undifferentiated mesophyll, conducting tissue and glands. (×600).

PLATE III.

Fig. 1.—T.S. stem, showing: (*a*), stoma; (*b*), lacunae in cortex; (*c*), broad cortex; (*d*), endodermis; arrangement of vascular bundles, and pith. (×600).
Fig. 2.—Branched hair on stem. (×120).

(*To be continued*).

DAYS AND DOINGS WITH MY BOBBERY-PACK.

BY

LIEUT.-COLONEL R. W. BURTON.

(*With one plate*).

What a crowd of memories the above heading brings to mind! Days of intense enjoyment and doings of delight. Up long before dawn, and out of the Cantonment before the short Indian twilight had broadened into day, we used to make our way to the appointed meeting-place where the dogs had been sent out overnight, or very early in the morning. Sometimes it was convenient to ride out, sometimes to drive, less seldom to cycle; and though there may have been occasional disinclination to forego several hour's sleep, yet the pleasure of being up early, seeing the dawn break and hearing the many interesting sounds of awakening life which is the reward of early rising, far outweighed any thoughts of slothfulness.

And that early morning meeting of Master and pack! What a pleasure it used to be. Each dog had its own distinctive manner of expressing delight. 'Bob', the poligar, staunch and stolid, quietly wagged his tail; 'Pup' showed her pearly teeth in a delighted grin; old 'Nelly', 'Bob's' inseparable companion, in spite of her twelve years of life, pranced about like a puppy; 'Paddy', his name proclaims his native land, who had always to be led by himself or with one of the opposite sex owing to his incurable penchant for a fight, used to have a special caress, for he was his master's shadow. So the memory runs back a number of years bringing to mind dogs big and dogs small, and of various breeds, for membership was open to all those keen of scent and stout of heart. Dogs, alas, are often but shortlived in this country of so many speedy and fatal ailments to man and beast.

Only two years short of five decades is it since the first nucleus of the Bobbery Pack was established. 'Stag', a Persian hound; 'Prince' an Australian; 'Jupiter', country-bred greyhound and a faint-hearted tackler who transmitted his failing to 'Jingo', 'Sloe', and others; 'Simon', most courageous of fox-terriers. These were the forerunners of dogs of varied breeds and colours.

'Stag' and 'Prince' it was who, one memorable morning, pressed a buck Chikara hard for some two miles, running in a circle, while 'Jupiter' ran cunning, made a fine effort at a well-judged moment, seized the gazelle at the loins and broke its back with a single bite. Well he knew it would not bite back! It is astonishing how very easily gazelle and antelope are killed by dogs, and yet how tenacious of life they are when struck by bullets. This feat was never repeated by any of my own dogs with an unwounded chikara as the victim; but old 'Nelly', when at her prime, alone and unaided killed a healthy and full-grown doe antelope among some rocky ground. It appeared to become confused so 'Nelly'

Jingo
Raichur 1895
R.W.B.
"Judy"

My Bobbery Pack—Raichur, 1895.

Pony "Fat man" "Jack" "Bob" "Nelly"
R.W.B.
1899
at Bolarum.
Photo by

My Bobbery Pack—Bolarum, 1899.

cut it off after a few minutes coursing, seized it by the neck and killed it instantaneously. She was half Persian, half Afghan, and a very handsome brindle. Poligar 'Bob', before he came into my possession, earned undying fame by seizing a hyaena by the ear and holding it until other dogs came up; how the beast was despatched history does not relate, probably with a hunting knife. A knife with stout blade of some six inches in length should always be carried.

Beginning in the days of 'Stag' and 'Jupiter'—'Prince' had to be destroyed as he made the killing of sheep and goats his principal occupation—, many a fine run after fox and jack is seen from the diary to have been had in the vicinity of the Cantonments at which the writer was stationed in those days when the life of the soldier-officer was less strenuous than it is now. Nothing to do after ten o'clock on five days of the week, and Thursdays and Sundays free. Jackals and foxes were numerous; and though the country was much cut up by nullahs, yet falls were few, the hardy and clever country-bred horses and ponies being nimble and seldom coming to grief.

On most mornings a run of some kind was obtained, the tale of 'tails' running well into the thirties for the period—March to September, when much of the hunting was done. During the cold weather the counter-attraction of shooting mostly gave the hunted animals a well-earned respite; a large number of them having been obliged, on one day or another to run for their lives.

At times there were some amusing incidents. On one occasion a spaniel took up a line and ran it hard for a hundred yards, whimpering excitedly as he went. Suddenly he found himself face to face with a big dog jackal. But 'Sammy' was a nervy little fellow and quite equal to the tactical situation; he lifted his leg against a bush, pretending that hunting hard on the tails of stray jackals was the last thing in the world of which he was thinking. Seeing me galloping in pursuit the jack once more set off with valiant 'Sam' hard on his heels. A blast on the whistle called up the scattered pack and after an excellent run the jack was duly accounted for.

The dogs very quickly learned to look for signs from Master that quarry had been sighted. All would turn at once towards the sound of the whistle and converge on the galloping pony. When the ground was open I used to have the faster dogs in a double slip-leash so as to give the fleeing animal a good start; for hunting with too speedy hounds is poor sport. Three or four hundred yards is not too much, in open country, to ensure a good run and equalize the chances of hunter and hunted. Foxes can usually take care of themselves pretty well though, owing to their habit of crouching and trying by this means to escape notice, they are sometimes 'chopped'.

Some foxes, however, are quite 'professional' runners among their kind and have on occasion gone clean away from fast hounds. It is really a very gallant sight to view a little *lomri* skate away with brush held straight behind him after having extended fast greyhounds to their best efforts for some two miles. This is due without doubt to foxes having a second wind; once they have managed to evade capture until they have gained this second wind they stand a very good chance of escape. In such cases the hounds drop from a canter to a walk and then, as the fox rapidly increases his lead, walk round and round in a state of utter exhaustion with heaving sides and far-protruded dripping tongues. Such defeats do not, however, affect their keenness on future occasions. It is but fair to the hounds to explain that the fox only achieves such a victory after having tired them by many twistings and turnings and agile narrow escapes, even to the skinning of the tail through the gaping jaws of the straining pursuer! It is not uncommon to see a fox jump over a dog's back when hard pressed and necessity forces him to such hazardous efforts at freedom.

One fox there was which raced away on near a dozen occasions before he finally succumbed to 'Nelly' after 15 minutes' hard gallop. He must have run twenty miles, one way and another, before he was killed.

Hares afforded good sport, dogs being always keen and excited in their pursuit. They run straight and are very speedy. It used to be a change for the men to turn out forty or fifty as beaters and slip the dogs at hares only. Early in the rainy season as many as eight would be killed in a morning in this manner. Such outings were much enjoyed by the men as well as being good training for them; for they had to control excitement, retain proper intervals, and keep in touch in scrub jungle.

The Indian hare readily goes to ground, it being common for them to take refuge down one of the tunnels of a white-ant mound. As cobras are very partial to these ready made and safe retreats I have often wondered whether the hare may not have been worse frightened when inside than when hunted therein by ravening hounds. His expression would be something like that of the baby cotton-tail 'Raggylug' in Ernest Seton Thompson's charming book on animal life.

Escapes from snake-bite were common, but it was rare to have a dog bitten, for instinct seems to warn them not to tackle. A fox terrier belonging to a friend was bitten in long grass and died twenty minutes after the yelp which announced the onset of the tragedy; while another faithful friend, 'John Pigeon', died twenty hours after being bitten while hunting among some rocks. The former snake was doubtless a cobra, the latter probably a Russell's Viper or Daboia. Snakes were seen almost every day, cobras and daboias being numerous. Whenever there was a chance of getting at these deadly reptiles I used to dismount and kill them. Sometimes my horses' legs used to be struck at, but never with success on the part of the snake. Daboias are sluggish but cobras very active and quick. On one occasion a half-bred pointer had a narrow escape. He was trotting along in front of me on a tank bund and suddenly leapt into the air over a snake. The big cobra struck at him, but the agile dog saved himself by an extraordinary effort—a wriggling jump while in the air, which just took him clear of the wicked expanded hood. Having failed in his strike the snake quickly disappeared in the grass.

To return to the hares. One of these once ran 1200 yards in a perfectly straight line and was killed by the speedy 'Dinah' just as it reached cover. The soil was hard and sandy, and the run so remarkably straight that we back-paced it, noting that the hare had not deviated more than a few feet from the straight line during the whole distance.

'Dinah' was bought for fifteen rupees at the Arab stables in Bombay, so also 'Jack', a Persian hound, costing twenty rupees. At that time too, 'Ginger', fiery Arab stallion, was acquired for six hundred rupees. A very gallant horse he was; a born steeplechaser, afraid of nothing, and did fourteen miles to the hour in a dog-cart. On one occasion he took off too far away from a mud wall built in the dry bed of a tank, hitting it with his chest. Naturally we parted, but he finished first!

'Dinah' was a true Arab of the desert. Her hereditary ability to withstand thirst was extraordinary; and even in severe hot weather, when all the other dogs would be greedily slaking their thirst, she never drank much, and often did not even do more than wet the tip of her tongue; also her tongue never protruded to the extent of the other dogs. 'Jack' had to be destroyed—rabies—, and 'Dinah' was never the same after she produced a litter to 'Poligar Bob'.

Only one of the six pups lived and I have never seen 'Pup's' equal. She could run rings round any of the other hounds I had. Pace, stamina, keenness, a good tackler, and the very best and most good natured of bitches. In those days I had no camera so have no photograph of her.

Thinking of 'Bob' brings to mind that clown Poligar 'Jacky' purchased for five rupees from a Horse Artillery syce: he turned out to be a great character. His first exploit was on his entry into the pack when only nine or ten months old. A fox was put up and jinked a great deal, at last running round a rock into 'Jacky's' gaping jaws which closed on him, the canine teeth being fixed into the back of the fox's head. 'Jacky' was nearly choked by the fox's nose sticking in his gullet so Master pulled his jaws open while 'Dinah' removed the fox. After this 'Jacky' was mighty keen and always a great tackler. Another of his exploits was the slaying of a village porker for which he had to receive a drubbing and I to pay his original purchase price.

I parted with 'Jacky' and the rest of my pack when going on furlough; a couple of years later I met him in the road and he growled ferociously at my friendly advances. A curious thing about this dog was that he had the smell peculiar to hyaenas; nothing would conceal it; no amount of washing was of any use; so he was banished to the stables. He was a clown of a dog, always playing pranks and amusing even to look at.

There are no better dogs for the Bobbery-Pack than the Poligar. Good tacklers, sound feet, not too fast, stand the heat, splendid staying power, and the best of constitutions. They come from the Poligar country in the south of India. In the early part of the last century the troops of the East India Company had many tough engagements during the Poligar War in the Tinnevelly District, as related by Colonel James Welsh in his Military Reminiscences. At the assault on one place only forty-six of the storming party of one hundred and twenty Europeans escaped unhurt. On that day four officers and forty-nine men were killed. Of one old Poligar it is related that, mortally wounded, he desired to be carried before the British Commander:—'The old man, who was placed upright in a chair, then said, with a firm voice, "I have come to show the English how a Poligar can die." He twisted his whiskers with both hands as he spoke, and in that attitude expired.' So the Poligars of that day were as stout-hearted as their almost hairless hounds.

A cross-bred bull-terrier should be in every Bobbery-Pack. I say cross-bred because pure bred ones cannot stand the heat, and soon knock up on a hot morning. Dog 'Tiger' was the best of this kind that I ever possessed. Sixty pounds in weight, with a head like a mastiff, he feared nothing and could pull down anything unaided. He was incorrigible in the matter of pulling down buffaloes. No buffalo, once 'Tiger' had him by the nose, remained on his legs for more than forty yards, and no amount of correction ever wholly cured him of this propensity; it was fortunate that he did not molest sheep or goats, for then he could never have been taken out. He died of jaundice, that disease so common and fatal to dogs in India.

None of my dogs were really savage. Rampur hounds have that reputation, and perhaps those of a Bihar Rajah were of that breed, though Doctor Daniel Johnson in *Indian Field Sports* calls them Persians, 'the Rajah slipped his Persian hounds after a jackal but when he hallooed on the dogs they mistook the object meant for them and attacked the Rajah's horse, obliging him to ride into the neighbouring river to escape their attack, to the great amusement of the gentlemen present and the Rajah's mortification'.

Dogs of the bull-terrier class are frequently ferocious towards animals though mild and good tempered to human beings; they require to be trained to habits of implicit obedience from their earliest puppyhood or they become a nuisance to their owner and a terror to the community. It is on record that so long ago as the year 1670, a bulldog owned by the Chief of a Factory on the West Coast of India slew a sacred cow (bull?) and the mob murdered every European in the place. The Monument to John Best and seventeen Englishmen thus slain records that: 'They were sacrificed to the fury of a mad priesthood and an infuriated mob.' (Things Indian by William Crooke).

Banjara dogs are very good but those of pure breed seldom to be procured, as their owners, that most interesting nomad tribe of gipsy appearance and habits, will not readily part with them. These dogs hunt by both sight and scent and being fast and courageous are suitable for every description of hunting and coursing. I owned half-bred ones now and again.

The best, and also the most pleasant time of year for the sport described is during the early part of the rains before the grass gets high and cover too thick. The fresh feel of the air and a tinge of green all over the countryside is a most extraordinary relief after the heat of the previous three or four months. Butterflies are to be seen in daily increasing numbers; where formerly was parched and arid soil all sorts of wild flowers magically appear; birds are busy feasting on the many insects swarming in the air; crows and kites are greedily chasing and devouring the lovely ground mites with scarlet plush bodies seen crawling over the ground in all directions, and if these are as good to eat as they are beautiful to look at they must indeed be delicious morsels. Then also myriads of flying white-ants issue from the termite mounds, providing a ready feast for foxes and jackals which I have found to have stomachs distended with the easily gorged meal.

It was my custom to always hold an autopsy of stomach contents and at that season jackals were found to be in the habit of eating various fruits, besides the many lizards, rats, mice, and small birds which were more easily come by at that time of the year.

Horses and dogs feel the change as much as their Master, and throwing off the lassitude which has held them during the hot weather months, show by their friskings and gambollings how pleased they are that the season of green grass and cool breezes has once more returned. An animal is sighted in the distance, and discovered after careful scrutiny to be a jackal sneaking homewards to the scrub jungle two miles to the north; so quietly trotting along we lessen the distance to about four hundred yards and then start galloping hard. To the sound of the thudding hoofs and the loud blast on the whistle the dogs come in from all directions, for they soon acquire the habit of scouting to the flanks on their own account, converging to a point ahead of the galloping horse, as they know their Master is invariably to be trusted. Soon the fastest among them gets a sight of the jack; this causes her to exert herself to the utmost and she rapidly gains on the stout varmint before her. He knows every inch of the country and heads for some nullahs and broken ground where he hopes to throw off the panting crew now hard on his heels. Greyhounds, hunting entirely by sight, are soon at fault when the quarry disappears from view and it is at such times that the experience and hard riding of their Master is so invaluable to them.

It is only by hard and judicious riding that one is able, in rough and broken country, to keep close enough to the quarry to enable the dogs to be put on to the line it has taken; so the success of the pack is often largely dependent on the ability of the Master. In the case now in mind the dogs are soon put on and another gallant jack is gathered to his fathers, his mask and brush being consigned to the bag slung at the saddle for the purpose.

Sometimes the fast dogs would be left at home, and the hunt conducted with the slower members of the pack, many of which had quite good noses. That also afforded good sport, and much that was interesting in the way of seeing the dogs at work.

Most of the hunting was around the Cantonments of Aurangabad, Raichur and Bolarum. Wolves were occasionally seen near the two former and hyaenas near the latter. 'Tiger' came into my possession at Bolarum so never had a chance at a wolf; nor did he come to grips with a hyaena as it was very seldom one was found away from unrideable ground: so neither of these beasts were accounted for by my pack. One day at Aurangabad, of course when not hunting—I came across two wolves returning, fully gorged to the hilly country from some antelope feast. My camp and servants, dogs, hog-spear, etc. had gone on before me so my sole weapon was the cleaning rod of my gun which had been left behind at my bungalow. I rode the wolves to a standstill, actually touching the male with the cleaning rod at which he showed a fine row of teeth. I left them in a pool of water in a sandy nullah and having found my camp returned with dogs and spear, but the animals had left and could not be found. That was an unique opportunity which never recurred.

On one occasion, again no pack and but a rook rifle as weapon, I had a great gallop after a hyaena. My friend on a big Australian pressed the hyaena hard and my much less speedy gray country-bred toiled in the rear. My nag eventually gave out while my friend was unable to use his rifle because of his pulling horse; so the beast made good his escape after a run of some three miles over the broken country east of the Trimulgherry rocks. That gallop lives in the memory.

It is marvellous what reckless riding the fast pursuit of animals induces. I can call to mind one memorable morning when a friend and myself galloped after a jack, in the endeavour to put the dogs on to him, over the top of a rocky hill, across several stone quarries, and down a steep, jungly slope on the other side. The jack was a fast one so we failed to get the hounds to see him and had to abandon the chase. A lady was out with us, a nervous rider, so we quietly made our way towards the place from which we had started a mile or so back, being positively astonished at the places we had galloped over and could not attempt to cross them at a walk. At one place my pony had attempted to stop at a perpendicular drop in the sheet rock, but being unable to do so had been obliged to drop some four or five feet on to a slippery surface down which he slithered for some yards before regaining his equilibrium, when he was again urged on his mad career. 'Ginger' was indeed a gallant beast and a great handful on such occasions. Truly fortune favours the reckless rider on most days, but the pitcher, not infrequently, goes too often to the well!

I have said little about the horses and ponies. Every man has his own ideas, which must be guided by his weight and inches. For those riding about 11 st. 7 lbs. and under nothing can be better than the Arab or good class country-bred. Moderately heavy weights can hunt on exceptionally large country-breds but must usually ride Australian animals. Big horses are rather unwieldy for the kind of hunting, or coursing, of which I have endeavoured to give a faithful picture. Handy, speedy, sure-footed animals are best suited to the business, and few would care to risk valuable mounts at such harum-scarum work. The pony in the photograph used to carry a small retainer as dog-boy and whipper-in !

To write of my Bobbery-Pack has been a pleasure, but the narrative must be brought to an end for fear it may become wearysome to readers who are possibly not such enthusiasts as myself. My hunting days are over and I may never again enjoy 'good hunting' except in the memories of the past; but can console myself with the philosophic conviction that once the inevitable has been submitted to there is much pleasure to be had in reflections on days of enjoyment in by-gone years.

THE INDIAN CADDIS FLIES (*TRICHOPTERA*)

BY

MARTIN E. MOSELY, F.R.E.S., F.Z.S.

(*With seven plates*).

PART VII.

(*Continued from page* 47 *of Volume* xli, 1939).

SERICOSTOMATIDAE McLACHLAN. (*Contd.*)

LEPIDOSTOMATINAE Ulmer.

Lepidostomatinae.—Ulm., Abh. Natur. Ver. Hamb., 18, p. 89, 1903.

Basal joint of the antennae usually much longer than the head, generally clothed with very long, outstanding hairs or scales, often in the ♂ with processes or spine-like teeth at the base; maxillary palpi ♂ generally membranous and clothed with thickened hairs or scales or both, number of joints varying from one to three, the normal five always in the ♀; labial palpi three-jointed in both sexes, basal joint small, about half the length of the second which is usually slightly shorter than the third; abdomen slender, no ventral teeth in either sex; wings generally oval, densely pubescent, in the ♂, often furnished with scales and also with grooves and folds, the former being more or less open furrows lined with scales, whilst the latter are strongly chitinized, closely overlapping portions of the membrane, generally in the post-costal area and usually in the anterior wing; often the costal margin of this wing is doubled over and concealed in a heavy fringe; sometimes there is a similar fringe along a central groove; the wings of the ♀ are more regular and there are neither scales, grooves nor folds present in this sex; spurs 2, 4, 4 or 1, 4, 4, varying according to the species.

McLachlan has termed the Sericostomatidae the 'Curiosity Shop' of the Trichoptera. This remark applies with particular force to its sub-family, the Lepidostomatinae.

Of the Indian species belonging to this sub-family, sixty species are described here, distributed in fourteen genera of which eight are new.

If the customary rule were to be here followed, namely of basing genera on neuration alone, their numbers would have to be still further increased. I have therefore departed from the usual practice and have sought for generic characters in the form of the genitalia, antennae, etc. as well as in neuration.

The grouping here adopted is perhaps arbitrary as my main consideration has been to enable the student to identify his material as easily as possible. It is probable that species in many of the genera in which I have placed them, are separated from each other by more important characters than those which I have selected to group them together. Probably the true affinities between the species will be recognized only when a knowledge of the larval forms has been obtained.

Key to the Genera.

This key applies to the male sex only.

1. Post-costal fold absent in the anterior wing. 2
—Post-costal fold present. 4

2. A black, shield-shaped spot on the metathorax, neuration in the posterior wing irregular Paraphlegopteryx Ulm.
—No spot on the metathorax, neuration in the posterior wing regular. 3

3. Maxillary palpi single-jointed. Kodala gen. n.
—Maxillary palpi two-jointed. Indocrunoecia Mart.

4. Penis-sheaths set abnormally slantwise across the genitalia. Dinarthrum McLach.
—Penis-sheaths symmetrical or absent (excepting in *Adinarthrella kimsa* sp. n.) 5

5. Inferior appendages with an upwardly directed branch arising at or near the basal margin as seen from the side. 8
—Other than above. 6

6. Basal joint of the antenna armed with either one or two basal processes. Dinarthrena gen. n.
—Basal joint of the antenna without processes. 7

7. Apex of the inferior appendages unbranched. Agoerodella gen. n.
—Apex of the inferior appendages branched. Adinarthrella gen. n.

8. Basal joint of the antenna armed with processes or rudiments of processes. 10
—Basal joint of the antenna simple. 9

9. In the anterior wing, generally a conspicuously long cell between the post-costal fold and the margin;* penis-sheaths wanting. Goerodes Ulm.
—Several cells, not conspicuously long in the post-costal area; penis-sheaths present. Agoerodes gen. n.

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* Except in *G. khasiana* sp. n. and *G. inequalis* Mart.

10. Basal joint of the antenna armed with two processes, one at the base, the second towards the middle. DINARTHRODES Ulm.
—Basal joint with a process or processes, sometimes rudimentary, situated at the base only. 11

11. Basal joint of the antenna with a furcate branch, sometimes with additional small branches at its base. 12
—Basal joint with a simple branch, or sometimes only the rudiments of a branch at its base. 13

12. Post-costal fold very long, situated towards the middle of the wing. ANACRUNOECIA gen. n.
—Post-costal fold short, situated towards the lower margin. GOERODINA gen. n.

13. In the anterior wing, post-costal fold situated slightly above the centre, long, extending nearly to the apex, separated from the marginal cellules by a triangular space. DINARTHRELLA Ulm.
—Other than the above. 14

14. Inferior appendages two-jointed, terminal joint, however, often obscure. ADINARTHRUM gen. n.
—Inferior appendages single-jointed, apices branched. GOERODELLA gen. n.

Dinarthrum McLachlan.

Dinarthrum McLach., Journ. Linn. Soc. Lond., Zool., xi, p. 116, 1871.

Indodinarthrum Mart., Rec. Ind. Mus., 38, p. 281, 1936.

Metadinarthrum Mart., Trav. Lab. Zool. Univ. Varsov, p. 70, 1913.

Hypodinarthrum Mart., op. cit., p. 91, 1913.

Acrunoecia Ulm., Genera Insect., fasc. 60a, p. 106, 1907.

Spurs 2, 4, 4.

In the ♂, antenna with the basal joint long, armed generally with distinct processes at its base. In certain species, however these are rudimentary, or absolutely wanting. Maxillary palpi two-jointed, basal joint longer than the second. Wings covered with hairs and scales except, perhaps, in *parvulum* where hairs only are present. Neuration irregular in the anterior, generally regular in the posterior; in the anterior, there is a post-costal fold more than half the length of the wing. Genitalia male, always with the penis-sheaths lying diagonally across the genitalia; inferior appendages two-jointed, second joint with the apex dilated; no upstanding branch at the base except perhaps in *D. kamba* sp. n.

Genotype: *Dinarthrum ferox* McLachlan.

Dinarthrum ferox McLachlan. Pl. 1. Figs. 1-5.

Dinarthrum ferox McLachlan, Journ. Linn. Soc. Lond., Zool., xi, p. 118, 1871.

Insect brown. In the ♂, wings covered with hairs and scales;

costa heavily fringed; post-costal fold long, with five large cellules between it and the posterior margin; basal joint of the antenna very long, with a sinuous process or branch at its base; maxillary palpi two-jointed, basal joint long and sinuous, terminal joint shorter, slender.

Genitalia ♂.—The apical margin of the ninth tergite strongly produced so that the tergite forms a broad triangle; beyond it, the dorsal plate is further produced at its centre which is slightly elevated to form a pair of parallel ridges with a deep cleft between; on each side of these ridges, the plate expands broadly, the lateral margins directed downward to make broad, deep keels while the lower margins of the central part are likewise extended; penis short; sheaths lying diagonally across it; inferior appendages two-jointed, basal joint broad from beneath, terminal joint short, apex slightly twisted and rounded.

Length of the anterior wing ♂ 10 mm.

Length of the basal joint of the antenna ♂ 6 mm.

North India. Capt. A. M. Langdale R. E.

Type and paratype ♂ in the collection of the British Museum, the type with the abdomen in balsam.

The genitalia has been drawn from the type, the abdomen having been cleared in KOH, the antenna and neuration according to McLachlan, the latter slightly amended.

Dinarthrum parvulum McLach. Pl. 2, Figs. 1-7.

Mormonia (?) *parvula* McLach., Fedtsch. Reise Turkestan, Neur., p. 33, pl. III, fig. 2, 1875.

Crunoecia (?) *parvula* McLach., Rev. and Syn. Trich., pp. 272-3, pl. XXIX, 1876.

Acrunoecia parvula Ulmer, Gen. Insect., fasc. 60a, p. 106, pl. XIV, figs. 123-4, 1907.

Dinarthrum parvulum Martynov, Trav. Labr. Zool. Univ. Warsaw, pp. 87-8, 1913; Ann. Mus. Zool. Ac. Sci. St. Peters., xix, pp. 432, 436, 1915.

Hypodinarthrum parvulum Martynov, Ann. Mus. Zool. Ac. Sci. U.R.S.S., xxviii, p. 468, 1927.

The examples before me were all collected in fluid; I am consequently unable to give any account of their general appearance.

McLachlan gives the expanse of the type (from Turkestan) as only 12.5 mm. for the male, and 14 mm. for the female.

The examples collected by Mr. Mitchell in Kashmir, are rather larger, the length of the anterior wing alone being 8 mm. in the male and 9 mm. in the female. In the majority of examples there is a very small angular projection at the extreme base of the antenna, concealed in the hairy clothing of the head. In one example, this process is wanting and there are slight differences in the neuration of the posterior wing but not enough, in my opinion, to warrant the separation of a distinct species. According to McLachlan, the pubescence is hairy, without scales.

Genitalia ♂.—Apical margin of the ninth tergite produced and rounded; beyond it is a complicated dorsal plate as wide as the segment, apical angles produced in large triangles with broad bases and very acute apices as seen from the side; margin of the plate produced in the centre in two adjacent finger-like processes as seen from above; from the side, it is seen that the finger-like processes are the upper edges of rounded heels of two boot-like plates set in the centre of the dorsal plate, the heels projecting above the margin and the much rounded toes appearing below its pointed apex; penis slender, curving downward, sheaths set at an angle across the penis, from above, pointing towards the left; inferior appendages two-jointed, basal joint long, apical joint very short, apex excised with a rather acute upper apical angle; margin of the ninth ventral segment slightly produced at its centre and widely excised.

Genitalia ♀.—From above, the ninth tergite is produced in two small pointed triangles beneath which is a hood-shaped structure, nearly square from beneath; towards the base of this hood lies a vulvar scale which is almost completely covered ventrally by a transparent, triangular plate; the vulvar scale has rather wide-based wings, the bases being produced laterally beyond and outside the covering plate; central process wide at its base with an acute apex.

Length of anterior wing ♂ 8 mm.
Length of anterior wing ♀ 10 mm.
Length of basal joint of antenna ♂ 2.3 mm.
Kashmir.

Dinarthrum inerme McLach. Pl. 3. Figs. 1-6.

Dinarthrum inerme MaLach., Scient. Res., ii, Yark. Mission, Neur., Calc., p. 5, figs. 1-4, 1878; Rev. & Syn. Trich., Suppl., Pt. II, pl. lxiii, 1880; Ulmer, Gen. Insect., fasc. 60a, p. 108, 1907.

Metadinarthrum inerme Martynov, Trav. Lab. Zool. Univ. Warsaw, p. 90, 1913; Ann. Mus. Zool. Ac. Imp. Sci. St. Peters, xix, p. 426, 1915; Ann. Mus. Zool. Ac. Sci. U.R.S S., xxviii, p. 468, 1927.

I will give McLachlan's original description of the species, supplemented by a description of the genitalia based on Kashmir material.

'Male, brownish, clothed with greyish-brown pubescence. Basal joint of antennae rather longer than the head and the entire thorax united, its basal portion black, but the apical portion brown, somewhat compressed laterally, nearly straight, but with a slight bend in the basal portion to about the middle (dry material M.E.M.), unarmed, but the basal half beneath, has a very dense fringe of thickened black hairs; this portion above, and all the apical half, are furnished with long outstanding grey hairs; thread of the antennae longer than the wings, pale yellow, very distinctly annulated with brown up to the tips. Maxillary palpi long and slender with a small terminal joint; the basal portion with long and dense thickened and ordinary grey hairs intermingled (but with no short scales), the terminal joint with ordinary hairs only. Labial palpi small and slender, pale yellowish. Legs pale yellow.

Anterior wings greyish; the costal margin for more than half its length from the base, has a dense inturned fringe of thickened blackish-grey hairs; the membrane lightly clothed with short greyish pubescence and with numerous small deep-black scales, but there is a broad median longitudinal space free from scales, limited inferiorly by a narrow groove extending from base to apex; apical fringes greyish, very long on the apical portion of the inner margin; neuration pale; discoidal cell short; nerves very irregular below the groove, forming large cellules. Posterior wings slightly paler than the anterior, with a few scattered black scales on the costal portion, but otherwise with only slight and very short greyish pubescence; fringes very long and greyish; discoidal cell very short.'

This is McLachlan's description of an example taken at Leh. The examples before me, from which the figures have been drawn, were collected by Dr. Hutchinson at Basgo, at about twenty miles to the west of Leh, at Leh itself, and other districts nearby.

McLachlan's description is so good that I have had no difficulty in determining Dr. Hutchinson's material.

Genitalia ♂.—The form of genitalia is very similar to that of *Dinarthrum parvulum* McL. Points of difference are as follows; from the side, the apical angles of the dorsal plate are shorter and rounded instead of acute, the penis-sheaths are broader and rather shorter; the basal joints of the inferior appendages are shorter, stouter and less curved whilst the margins of the apical joints are less excised; from above, the centre of the margin of the ninth segment is more produced whilst, from beneath, the margin of the same segment is produced at its centre instead of evenly concave.

In the ♀, the neuration agrees very closely with that of *Dinarthrum parvulum* McL.

Length of anterior wing ♂ 8 mm.
Length of anterior wing ♀ 8 mm.
Length of basal joint of antenna ♂ 2.2 mm.

Type probably still in the Indian Museum, Calcutta. Examples in the British Museum, collected by Dr. G. E. Hutchinson.

Dinarthum rema sp. n. Pl. 4. Figs. 1-4.

Insect more or less brownish in colour. In the ♂, basal joint of the antenna long with two processes at its base; unfortunately, in the type, only one antenna is present and the basal processes in this have both the tips broken off. Maxillary palpi two-jointed, basal joint long and sinuous; labial palpi with the second joint longer than the first but shorter than the third. Wings covered with hairs and scales, the latter more or less confined to the apical part of the anterior wing in which there is the usual fold in the post-costal area and also a longitudinal groove densely lined with scales, passing along the centre; all the forks in both wings sessile; in the posterior, the fourth apical cellule extends much further inwards than the base of the discoidal cell.

Genitalia of the usual *Dinarthrum* pattern; dorsal plate showing a specific character as shown in the figure.

Length of the anterior wing ♂ 9.5 mm.
Length of the basal joint of the antenna ♂ 4.9 mm.
Punjab: Muree, 92-98, Harford collection.
Type ♂ in the collection of the British Museum.

Dinarthrum kamba sp. n. Pl. 5. Figs. 1-5.

In the ♂, basal joint of the antennae long with two processes at its base, the basal process curved and with an acute apex, distal process short and spatulate; maxillary palpi two-jointed, basal joint sinuous, about twice the length of the terminal joint, labial palpi with the second joint longer than the first and shorter than the third; wings covered with scales, all forks sessile; anterior with a longitudinal groove along the centre of the wing, post-costal fold moderately long, three basal cellules along the posterior border, the middle one the largest; discoidal cell long and narrow, fork No. 1 arising at the extreme upper distal angle; in the posterior, the fourth apical cellule extending further inwards than the basal angle of the discoidal cell.

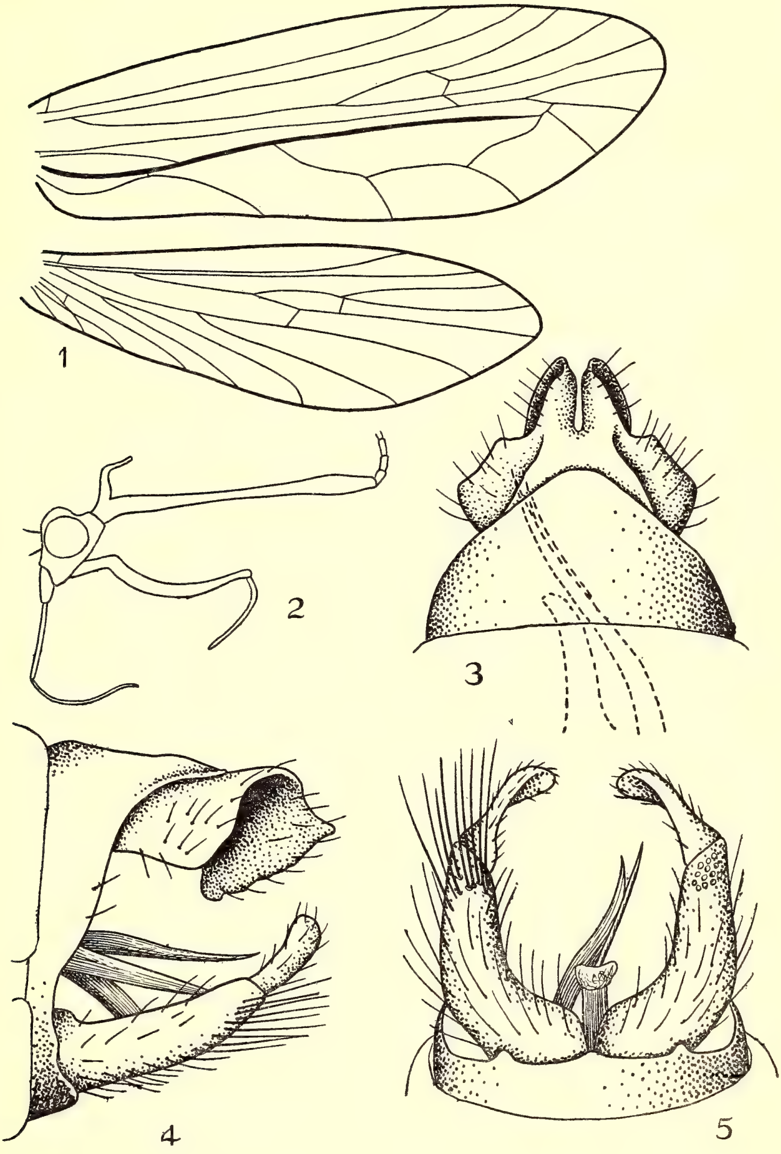
Genitalia ♂.—Ninth dorsal segment produced in a large, somewhat rounded triangle beyond which is a wide but shallow dorsal plate narrowly excised at its apex; the plate is roughly triangular with very slight productions of the lateral angles; inconspicuous vertical plates attached to the under surface; lateral angles of the ninth segment turned inwards and produced in small, finger-like processes; penis short, arching downward; sheaths broad excepting towards the apices where they are abruptly acute, and lying diagonally across the genitalia; inferior appendages furcate, two-jointed, terminal joint clavate and excised at its apex, outer surface strongly fringed; a small, triangular fork arising from the upper and inner margin of the basal joint at its base, directed distally.

Length of the anterior wing ♂ 6 mm.
Length of the basal joint of the antenna ♂ 2.35 mm.
N.-E. Burma: Kambaiti, 6,300 ft. 12-vii-1934, R. Malaise.
Type ♂ in the Stockholm Museum. Paratypes in the Stockholm and the British Museums.

Dinarthrum nagana sp. nov. Pl. 6. Figs. 1-6.

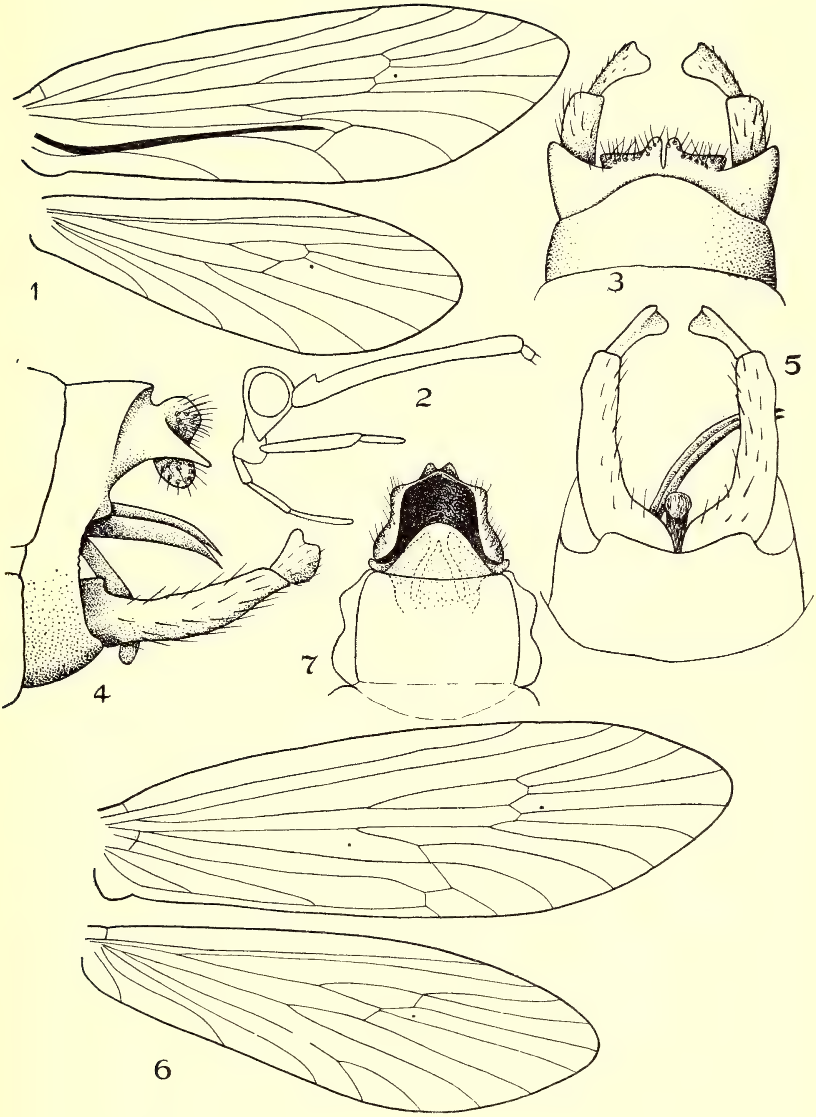
Insect light greyish; in the ♂, antennae, basal joint very long, with two basal processes, the apex of the lower curved inwards and dilated in a membranous sac, the upper, stout, with the upper margin convex; maxillary palpi two-jointed, basal joint long, with a small nodule towards the apex; terminal joint short; wings ♂, greyish with scales and hairs; anterior with a groove along the centre and a post-costal fold extending nearly to the apical margin; sixth apical cell with a short foot-stalk; four cellules in the post-costal region, the middle one being very large; posterior wing in the type, with the fifth apical sector incomplete at its base.

Genitalia ♂.—Ninth dorsal segment produced in a broad triangle with a broad, truncate apex; beneath this is the dorsal plate, apical excision not very deep, leaving two rounded lobes and rounded outer angles; inner lobes in the form of rounded plates, very large

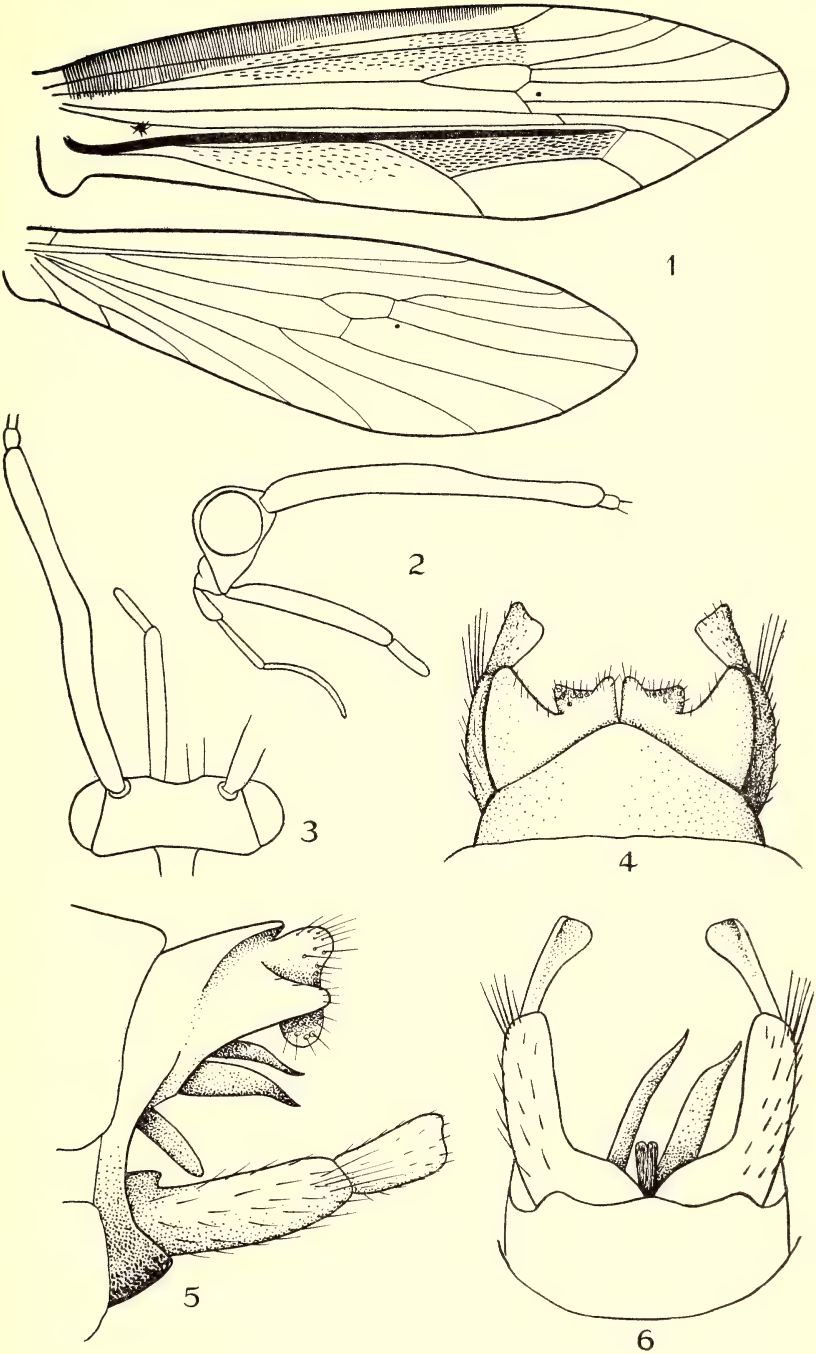


Dinarthrum ferox McLach. ♂.—Fig. 1, wings. Fig. 2, head, antenna, etc. Fig. 3, genitalia dorsal. Fig. 4, lateral. Fig. 5, ventral.
(Fig. 2, after McLachlan)

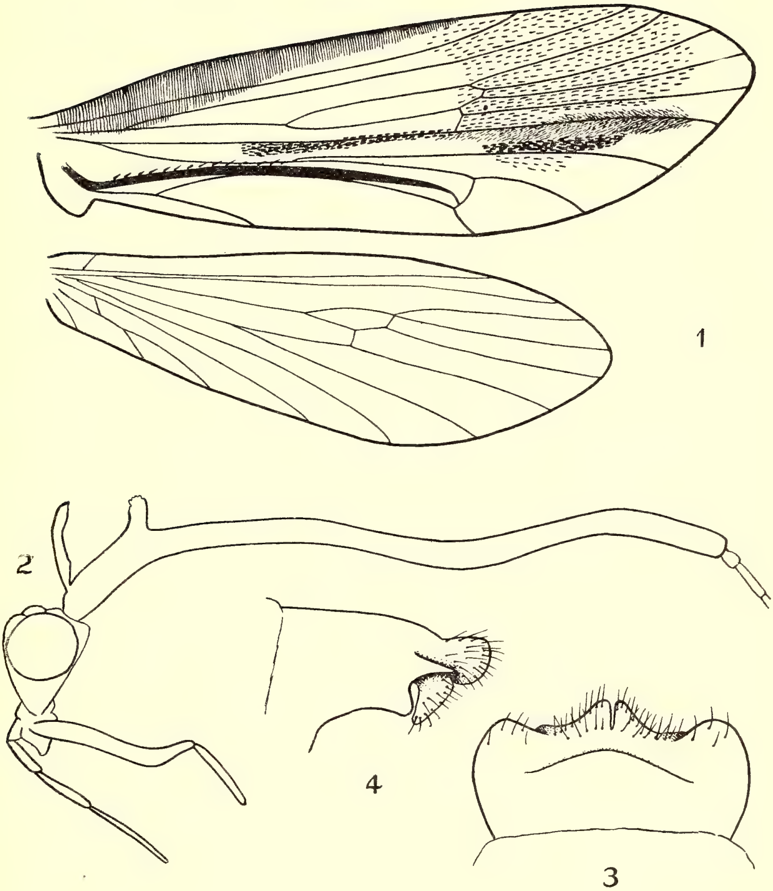
PLATE II



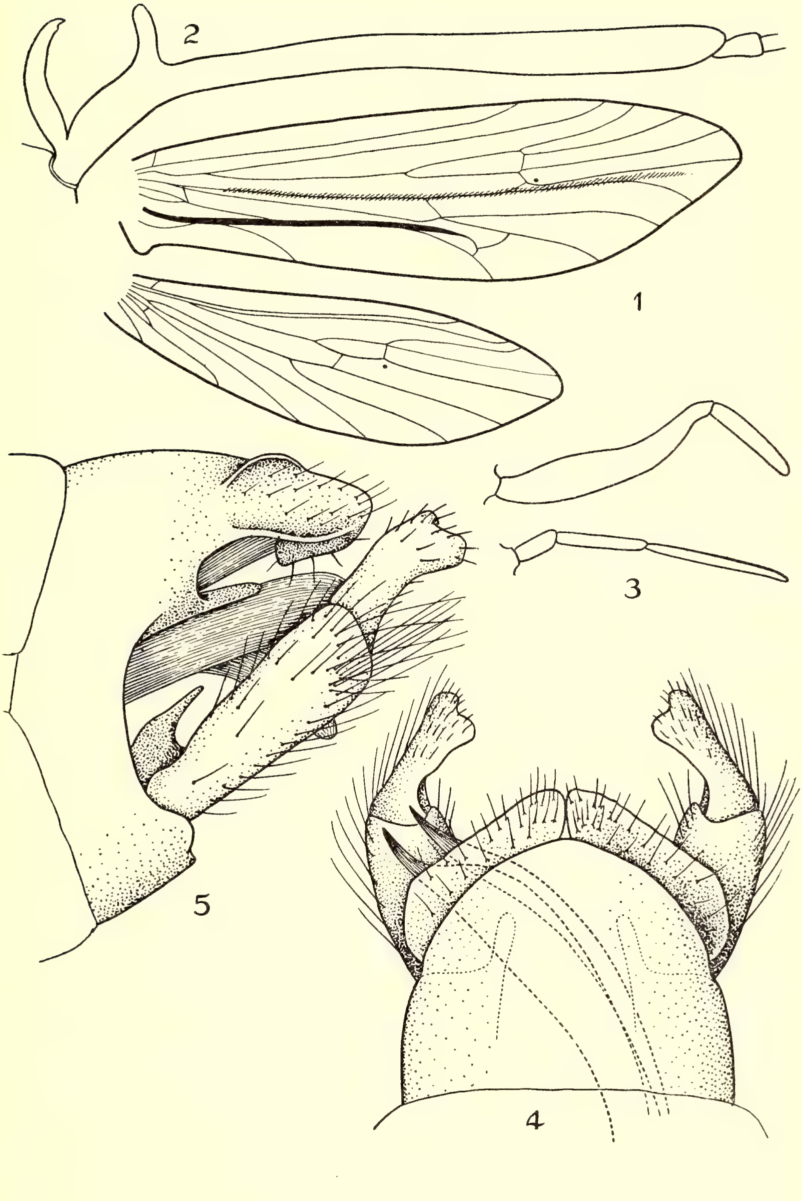
Dinarthrum parvulum McLach.—Fig. 1, wings ♂. Fig. 2, head and antenna, etc. ♂. Fig. 3, genitalia dorsal, penis and sheaths omitted ♂. Fig. 4, lateral. Fig. 5, ventral. Fig. 6, wings ♀. Fig. 7, apex of abdomen ♀, ventral.



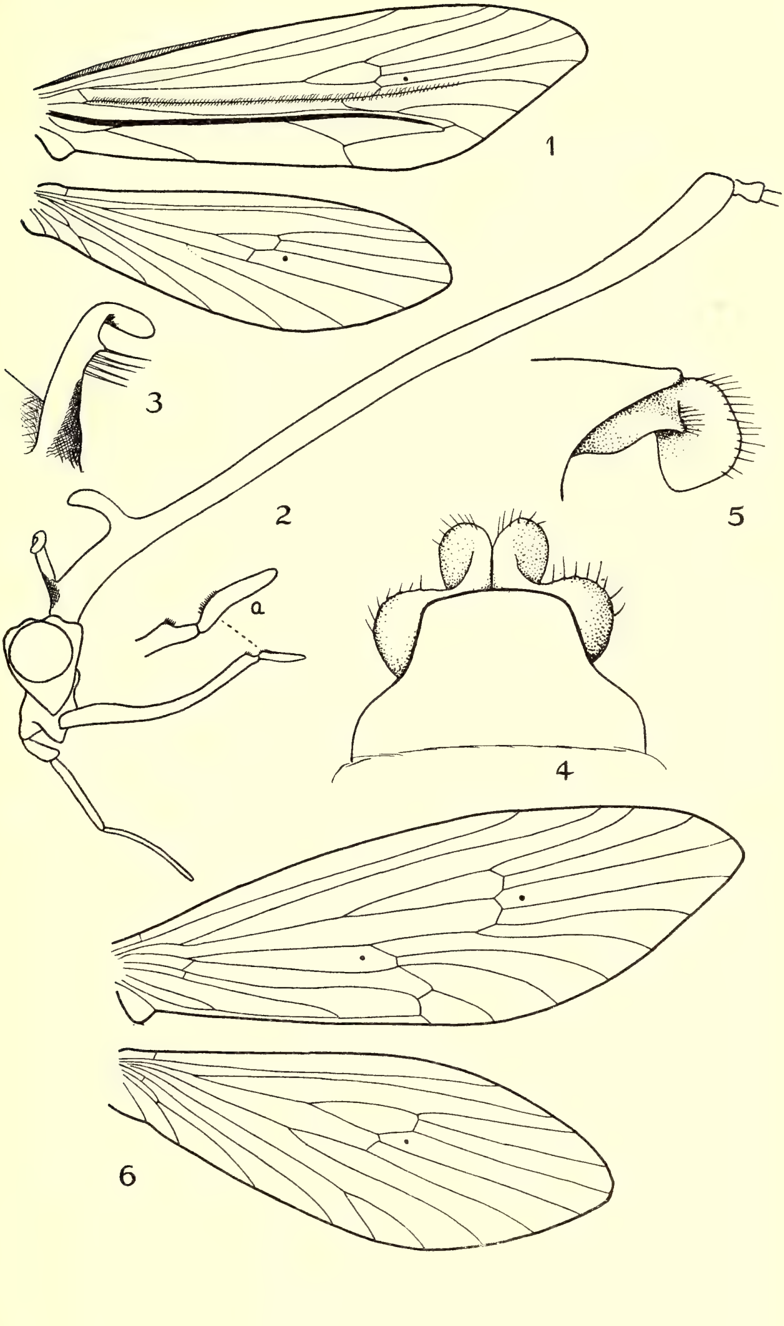
Dinarthrum inerme McLach. ♂.—Fig. 1, wings. Fig. 2, head, antenna, etc. Fig. 3, same from above. Fig. 4, genitalia, dorsal. Fig. 5, lateral. Fig. 6, ventral.



Dinarthrum rema sp. n. ♂.—Fig. 1, wings Fig 2, head and antenna, etc. Fig. 3, dorsal plate. Fig. 4, same, lateral.

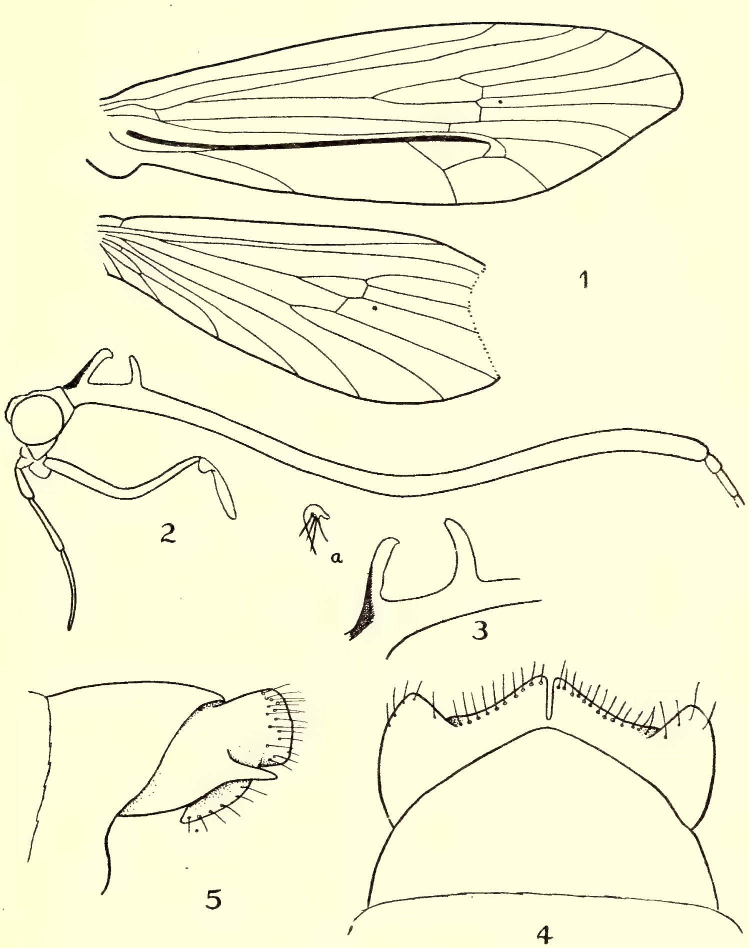


Dinarthrum kamba sp. n. ♂.—Fig. 1, wings. Fig. 2, antenna. Fig. 3, palpi. Fig. 4 genitalia, dorsal. Fig. 5, lateral.



Dinarthrum nagana sp. n.—Fig. 1, wings ♂. Fig. 2, head and antenna, etc., (*a*) termination of maxillary palpus, more enlarged ♂. Fig. 3, basal process of antenna, from above, more enlarged. Fig. 4, ninth tergite and dorsal plate ♂. Fig. 5, same, lateral. Fig. 6, wings ♀.

PLATE VII



Dinarthrum sonomax sp. n., ♂.—Fig. 1, wings. Fig. 2, head and antenna, etc., (*a*) apex of basal process, from above. Fig. 3, basal processes, more enlarged. Fig. 4, ninth tergite and dorsal plate. Fig. 5, same, lateral.

and deep from the side; penis short, arching downward, sheaths long and directed asymmetrically to one side; inferior appendages two-jointed, of the usual *Dinarthrum* type, the terminal joints short with clavate apices.

Length of anterior wing ♂ 9 mm.

Length of anterior wing ♀ 12 mm.

Length of basal joint of ♂ antenna 5.7 mm.

Kashmir: Nara Nag, ft. 7,500, 22-ix-1930, Lt.-Col. S. R. Christophers, B.M. 1930—159.

Type ♂ and paratype ♀ in the collection of the British Museum.

Dinarthrum sonomax sp. n. Pl. 7. Figs. 1-5.

General appearance brownish. In the ♂, basal joint of the antenna very long, under side blackened, two processes at the base, the basal of the two blackened on its upper surface and produced in an incurved, acute apex where there are three or four inwardly directed, strong spines. Maxillary palpi two-jointed, a short, membranous nodule at the base of the second joint. Wings long, with acute apices; anterior, with a fold in the post-costal area and a scale-lined, longitudinal groove occupying the middle of the wing; all forks in both wings sessile; in the anterior, there are three large cellules along the posterior margin, one of which, the central, may be a fork No. 5; above the fold, there is something in the nature of a corridor which curves round into this cellule; in the posterior wing, the fourth apical cellule extends about as far inwards as the base of the discoidal cell.

Genitalia conforming with the usual *Dinarthrum* pattern with a characteristic dorsal plate as seen in the figure.

Length of the anterior wing ♂ 13 mm.

Length of the basal joint of the antenna ♂ 7.9 mm.

Kashmir; W. Tibet: Sonamarg, 28-ix-1932 (Yale North India Expd.), G. E. Hutchinson.

Type ♂ (Sonamarg) and paratype ♂ (Kashmir) in the collection of the British Museum.

(*To be continued*).

MARINE FISHERIES OF THE PROVINCE OF BOMBAY.

A Report on the Experiments to Improve Methods of Transport, with Recommendations on Measures for General Development.

BY

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(*With one plate, a map and a graph*).

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Introduction.

1. The introduction of power-propelled vessels by the Government of Bombay to help the fishing industry has served to awaken interest in our fisheries which till comparatively recently had been in a generally neglected condition.

That interest has been aroused by this experiment in Bombay and in other maritime provinces of India and Ceylon is borne out by the numerous inquiries addressed to my department about the commercial possibilities of a more extended use of launches for the transport of fish. There is no doubt that the launches have made available in Bombay an increasing supply of fish, which, far from creating a glut in the market, has scarcely sufficed to meet the demand. In Bombay, at least, there is an insistent and constant demand for fish, and the use of more rapid and effective transport has helped to meet it The results achieved during the past five years show the great potentialities of power-propelled vessels to extend and develop transport, which like other branches of the industry is still in a primitive and disorganized state.

This résumé surveys the experience of the past five years, records the difficulties that have been encountered and indicates the appropriate lines on which our fishing industry should be developed if it is to flourish and prosper in the future.

GENESIS OF FISHERIES EXPERIMENT.

2. The improvement of the fishing industry has engaged the attention of the Government of Bombay for a considerable period. The first tangible step taken in this direction was in 1923, when the Government of Bombay purchased the Trawler *'William Carrick'* and appointed Mr. A. E. Hefford as marine biologist on board this vessel. Mr. Hefford's work, carried out along the coast of the Bombay Province, was exclusively confined to trawling experiments. The results were published in his *Report on the work of the trawler 'William Carrick'*. The experiment, for reasons subsequently indicated, was unsuccessful. Some information was collected, but there was no direct benefit as such to our fishermen. The main object of the work was to gauge the commercial possibilities of trawling in our waters.

The problem of directly improving the lot of the fishermen was investigated subsequently by Mr. P. B. Advani, the Director of Industries, Bombay, who was asked by the Government of Bombay to submit a report on the marketing of fish in the city of Bombay and to suggest measures for its improvement. The Director of Industries interviewed the Superintendent of the Crawford Market, leading fishermen and fish merchants about the possibilities of increasing the city's supply of fish. The inquiry revealed that there was scope for a considerable increase in the quantity of fish normally received in the Bombay markets, and that an additional 3,000 to 4,000 tons might easily be disposed of annually without elaborate and costly effort. The position in the mofussil, on the other hand, was still more unsatisfactory. In several districts, fish as an article of diet was, more often than not, a luxury which only a few could afford. Mr. Advani's inquiry, indicated that the introduction of power-propelled vessels in the local trade would considerably help to improve the prospects of the fishermen and augment the city's supply of fish. The immediate outcome of the inquiry was the establishment in November, 1933, of a Fisheries section attached to the Department of Industries, Bombay.

The introduction of power-propelled vessels, as a means of rapid transport and of extending the sources of supply, was also advocated by Dr. H. T. Sorley, I.C.S., who conducted a survey of the entire fisheries of the Bombay Province including Sind in 1930-32. The results of his investigations are set forth in a Blue Book entitled *The Marine Fisheries of the Bombay Presidency*.

Sir Frederick Sykes, then Governor of Bombay, manifested a keen interest in the welfare of the fishermen. Shortly before the inauguration of the fisheries experiment, His Excellency visited the Koli community at Colaba in Bombay, to acquaint himself personally with the difficulties under which they laboured. He felt that many of the obstacles confronting the fishermen in the development of their trade might be gradually overcome, and believed that there was considerable scope for the improvement of their condition, provided that their traditional methods of work were reformed and placed on a more modern and systematic basis.

The first objective of the newly established Fisheries Department was to ascertain the benefits which would accrue to the city's fishing industry from the use of motor launches for the transport of fish from the fishing grounds to the city. The traditional means then, and even now, employed were ordinary sailing craft. In inclement weather such craft are frequently compelled to remain at the fishing grounds and are unable to land the catch at the bunders, or they are confined to port when there is a total lack of wind, or when rough seas prevail, with the result that no fishing is done or the catch meant for transport to the city decays and has to be jettisoned. Fish meant for the markets is thus lost, and the fishermen's labours are wasted. Further, absence of wind frequently prevents a quick return to port, with the result that large quantities of fish are landed in a rotten condition. The initial step was therefore to provide more efficient and rapid means of transport and, as an experiment, Government decided to obtain a launch and use it for the transport of catches between the fishing and landing sites.

INAUGURATION OF EXPERIMENT.

3. Sir Frederick Sykes inaugurated the fisheries experiment at Danda on November 10, 1933.

The first power-propelled vessel to be used by Government was one worked by a petrol engine. She was named the '*Lady Sykes*', and was obtained on loan from the Royal Indian Navy (then the Royal Indian Marine). Suitable alterations were carried out to adapt her for use as a fish carrier. Government further sanctioned the construction of two motor boats. In the hope that the fishermen might eventually be able to take charge of and operate their own launches, Government provided five stipends of Rs. 20 each per month for the training of five apprentices of the fishermen's community in the operation and maintenance of motor launches.

Government were not, however, the first in the field in this respect. At least three months prior to the inauguration of the experiment at Danda, private enterprise had been responsible for a venture on similar lines. With a view to finding fresh outlets for its products, the Burma Oil Company had conducted an independent investigation and arrived at the conclusion that the city's supply of fish might be considerably augmented by the use of power-propelled boats.

Realizing, however, that the purchase of power-propelled launches would be beyond the slender resources of a great many of the fishermen, the firm decided to convert an ordinary sailing boat into a power-propelled boat. The guiding factor in view was that if, and when, the fishermen decided to go in for launches, they need not discard their sailing boats numbering thousands, but need merely install a suitable engine in them. The Burma Oil Company accordingly purchased from the fishing village at Worli a newly constructed fishing boat measuring 24 feet in length, and fitted it with a A 10 B.H.P. Kromhout engine. Considerable structural alterations were necessary, however, before this could be done.

BEGINNINGS OF A FISHING FLEET.

4. (*a*) *Conversion of sailing boats into power-propelled vessels.*

The Department of Industries simultaneously examined the possibility of converting ordinary sailing boats into vessels capable of propulsion by Diesel engines. The opinion of experts consulted by the Department was that fishermen deciding to use mechanically propelled boats to collect and transport fish need not perforce incur expenditure on the acquisition of new boats. The possibility of ordinary sailing craft being converted into power-propelled boats was demonstrated by further experiments by Messrs. Greaves Cotton & Co., who successfully converted a number of country craft into passenger and cargo-carrying launches. The survey on which these experiments were based showed that only one in every 20 of the ordinary sailing craft was capable of conversion into a mechanically propelled unit.

(*b*) *Construction of launches by the Department of Industries and unofficial agencies.*

The outcome of these experiments was most encouraging. The results obtained from the use of the vessels placed at the service of the fishermen by Government exceeded the most sanguine expectations. Equal fruit was borne by the Burmah Oil Company's venture. There, thus, appeared to be a promising future for the regular employment of power-propelled vessels in the fish trade. Accordingly in 1934 Government, impressed with the advantages accruing from the experiment at Danda, placed an order for the construction of two launches with Messrs. Alcock Ashdown & Co. Ltd. Steps were taken to eliminate from these launches the defects revealed in the '*Lady Sykes*', which had been adapted to the purpose of a fish carrier. The two new launches were the '*Sir Frederick Sykes*' and the '*Lady Sykes*', and they continue to be in use today. Appendix I shows the lauches constructed by the Department of Industries and also those owned by private individuals. It further shows the progressive increase in the horse-power of the engines installed in the vessels.

'*Lady Sykes*' and '*Sir Frederick Sykes*' (1934).—The '*Lady Sykes*' is equipped with a 28.5 B.H.P. Gardner engine, and the '*Sir Frederick Sykes*' with a 38.5 B.H.P. Ruston-Lister engine The launches, which are capable of average speeds of seven and eight knots, respectively, were equipped with different types of engines in order to test their suitability for the purpose of fisheries work. The total length of each launch is 35 ft., breadth 10 ft. and depth 4 ft. 9 in. Both vessels, which were built in the same year, have life-buoys, life-jackets, fire-extinguishers and the usual navigation lights. They burn crude oil. They were put into commission in September and October, 1934, respectively.

Launch 'Hydari' (1934).—The success of the original '*Lady Sykes*' induced Mr. Hasanaly Ebrahim, a fish merchant, to build a launch for his own use. It was constructed at Bassein by local carpenters at the same time as the '*Sir Frederick Sykes*' and '*Lady Sykes*'. Mr. Hasanaly's launch, the '*Hydari*', is fitted with Modaag Krupp Diesel engine. She is 41 ft. in length, has a 10 ft. beam and a draft when loaded of 3 ft. Her speed is five knots. The engine, a single cylinder pattern, operating on the two stroke principle, is claimed to develop 25 B.H.P.

'Lady Brabourne' (1935).—The following year saw the addition of the *'Lady Brabourne'* to the fleet. She, too, was built by Messrs. Alcock Ashdown & Co. and is a great improvement, both in point of size and engine power, on her predecessors. Her dimensions are :—length 42 ft., breadth 11 ft. 2 in. and depth 5 ft. 3 in. She is fitted with a Ruston-Hornsby '3VQM' marine engine, developing 52 B.H.P. at 1,000 r.p.m.

Fishermen, who till then had felt that the provision of power transport was beyond their means, came to realize from the results achieved that motor launches could play an important part in their trade and that their more extended use would fundamentally improve their prospects.

Trawler *'Cymbria'* (1936).—The launching of the fisheries scheme at Danda had synchronized with the experiment conducted by Mr. P. Schulze, who brought out about the same time a small second-hand trawler from Hamburg for deep sea fishing in the waters around Bombay. A company of four share-holders was floated, but owing to a variety of causes, among them repairs to the trawler's engine, the lack of sufficient capital and the poor catches due to unfavourable weather, the results were very disappointing and the experiment was abandoned. The vessel lay idle for some time and was later reconditioned for use as a fish carrier. It served in this capacity from October 1936 till September 1938, when it ran aground off the rocks near Colaba lighthouse and became a total wreck.

'Chandtara' (1937).—The *'Chandtara'* constructed in the same year by local carpenters at Vijaydurg is 46 ft. 9 in. × 10 ft. 5 in. It is equipped with a 52 B.H.P. Ruston Hornsby engine and is capable of developing a speed of seven knots.

'Lord Brabourne' (1938).—The *'Lord Brabourne'*, an up-to-date craft, was constructed by the Royal Indian Navy, who, in designing the vessel, ensured that it would be a model craft, the best in the fishing trade on the Bombay coast. It is the largest boat so far built, its dimensions being 45 ft. × 11 ft. × 5 ft. 6in. It has a 57 B.H.P. Gardner engine, which unlike the other launches is installed amidship. Its distinguishing feature is a cork insulated hold provided to minimize the melting of ice and to ensure the fish being kept in sound condition. Another welcome feature, greatly appreciated by the crew, is the provision of large oil and water tanks, which carry the entire quantity of fuel oil (200 gallons) and water (65 gallons) needed for the round voyage, usually lasting about five days. The provision for this storage in the engine room, apart from making for more deck space, also ensures the tidiness and cleanliness of the vessel, both important factors in dealing with so rapidly a perishable commodity as fish. Another aspect in which the new vessel surpasses the older launches is the equipment with electric lighting. She is fitted with a 12 volt battery and a dynamo which is driven from the engine. A photograph of the *'Lord Brabourne'* appears at the end of this account.

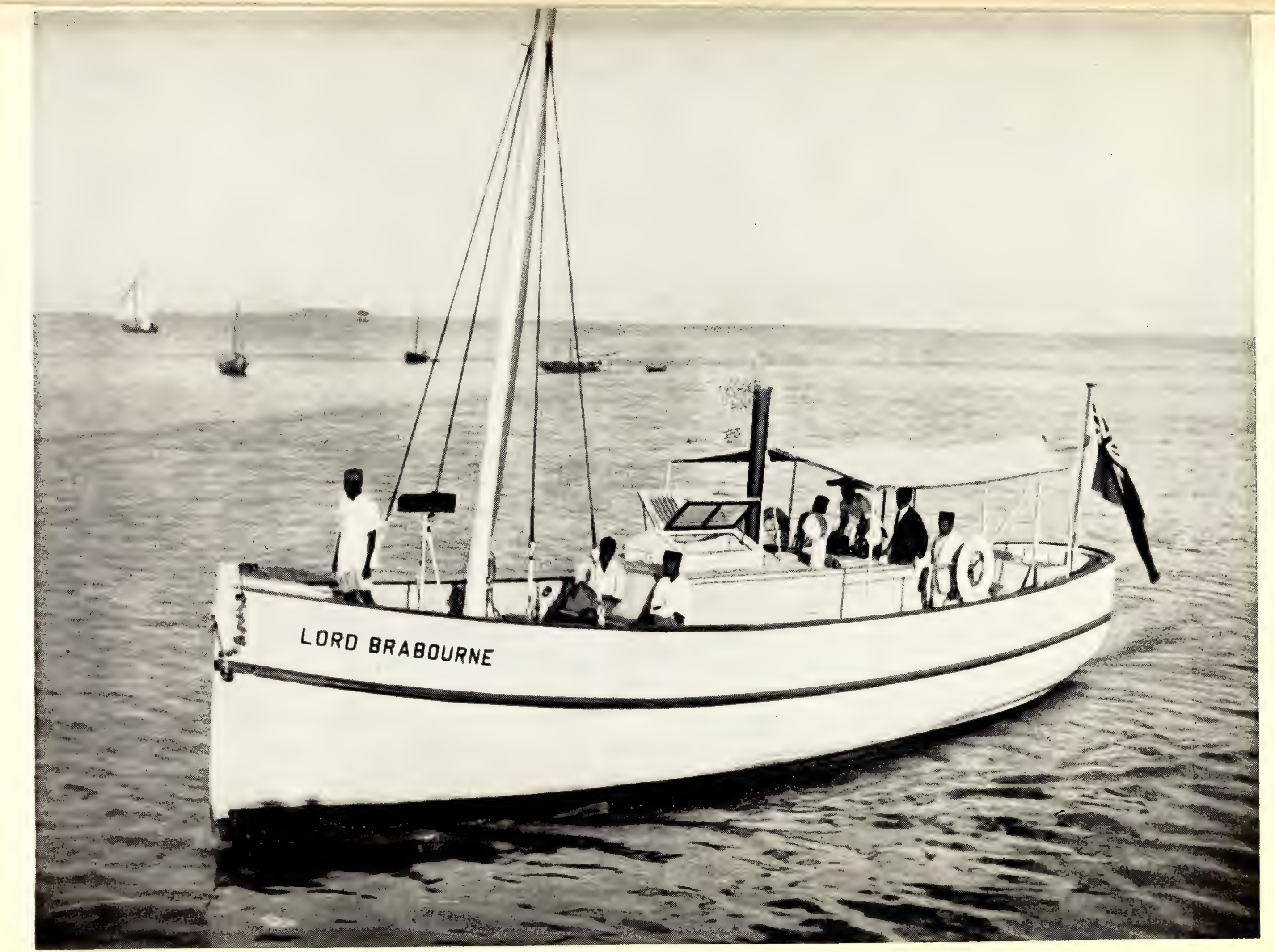
'Nooremohomedi' (1938).—This vessel was built at Vijaydurg by local carpenters. She is equipped with a 70 B.H.P. Ruston Hornsby engine and provides evidence of the growing tendency to install larger engines and build bigger boats than formerly.

'Seahawk' and *'Karimi'* (1938-39).—The vessel *'Seahawk'* was put into service by the Janjira Fishing Co. till the owners Messrs. Damania & Co., boat builders, were in a position to deliver the new vessel the *'Karimi'* which they had been commissioned to build. The *'Karimi'* which is equipped with a 40 B.H.P. Ruston Hornsby engine, worked during 1938-39, between Shrivardhan and Bombay.

'Khajahind' (1939).—This is the latest addition to the fishing fleet. She was constructed at Vijaydurg and is equipped with an engine of twice the horse-power of any other engine on existing vessels, namely, 140 B.H.P. Her length is 56 feet.

FIELD OF OPERATION OF THE LAUNCHES.

5. In the early stages of the experiment the field of operation of the launches was confined more or less exclusively to the north



LORD BRABOURNE

of Bombay, extending as far as Bassein. The vessels brought fish from Versova, Maloni, Gorai, Utan, Bassein and Arnala, in the north, and from Revdanda and adjacent sites in the south. The time taken for the voyage to the farthermost point, north or south, was about three hours. Fish, however, was customarily brought to Bombay by sail boats from these areas. It was therefore realized that the working of the launches within this limited field would not exactly serve the main purpose of the experiment, which was to demonstrate to the fishermen the possibility of increasing the city's supply of fish by exploiting additional and more extended sources of supply.

Arrangements were accordingly made for the launches to journey to more distant fishing sites. The first voyage beyond the usual sphere of operations was undertaken in November 1934, when the '*Sir Frederick Sykes*' went to Jaigad (about 100 miles from Bombay) and returned with an ample catch. Both the '*Sir Frederick Sykes*' and the '*Lady Sykes*' subsequently made alternate voyages to Jaigad and other ports close by, whence they returned with catches of mackerel and other fish. The bulk of the fish transported in 1934-35 was from Jaigad. Catches in 1935-36 were unsatisfactory owing to scarcity of fish both at Jaigad and Ratnagiri, and the launches, therefore, ventured yet further afield. Since September, 1935, all the three Government launches, as well as privately-owned vessels, have operated regularly as far as Karwar, which is nearly 270 miles from Bombay. They also made occasional voyages to Bhatkal, which is the southernmost point of the Province, about 334 miles from Bombay. Transport operations in the north extended as far as Damaun and Kathiawar, which were also tapped as sources of supply to the city. The first voyage was to Diu and was made by the '*Hydari*' in 1935. This vessel went to Madhwar, at the extreme south end of Kathiawar, about 150 miles from Bombay. The prevailing view till then had been that the passage to these fishing sites was unsafe for such small craft, as part of the route lay across the open sea through the Gulf of Cambay. The ease with which the passage was accomplished encouraged other owners to send their launches to Madhwar, which, since the first experimental voyage by the '*Hydari*', is now regularly visited.

The performance of the launches is very creditable in view of their small size, limited horse-power and lack of sufficient facilities for storage. From a limited radius 20 miles North and South of Bombay the fishing grounds now served by the launches have been extended from 270 to 300 nautical miles from Bombay, the duration of one round voyage being generally from 3 to 5 days. The important fishing fields brought within the sphere of operation both north and south of Bombay are indicated in a map appearing as Appendix 2 to this report.

Like the launches, sail boats also operate as fish carriers, but the field is necessarily restricted on account of the longer time taken by them on the voyage, and the consequent deterioration of the catch by the time it reaches Bombay. The only long distance voyage performed by the sail boats is from Madhwar (Diu) to

Bombay, from where fish is brought to the city. Madhwar is about 140 miles to the north of Bombay and the distance is usually covered by a sail boat in about two days. Quick transport from the northern fishing sites by sailing boats is facilitated by the favourable winds which blow from the north during the first half of the year. The season starts early in March and continues up to the latter part of May, when the onset of the monsoon compels suspension of fishing operations; but fishing fields in the south situated at the same distance or nearer than Madhwar are however unable to send their catches to Bombay in sailing boats because the strong head winds encountered on the homeward journey considerably prolong the voyage to the detriment of the catches.

The prospects of a regular launch service for the transport of fish between Bombay and the fishing fields near Diu in the north and off the Konkan coast in the south are most promising. The working of the launches in the Konkan and Kanara areas has shown that the sphere of operations in the south might easily be extended to Bhatkal and even as far south as the west coast of the Madras Presidency where fish is obtained in much greater abundance than off the Bombay coast; while in the north Jamnagar and even Karachi might be brought within the field. This consummation is not impossible of achievement. It will be the next inevitable step, for there is an increasing tendency to construct larger vessels to serve fishing sites where catches are cheaper and more abundant, but which have not so far been touched for want of transport facilities.

It is a noted fact that the further south one goes the richer and more profitable is the yield for readily saleable fishes, such as mackerel and sardines, which move in great shoals and form the bulk of the haul off the Malabar coast. This mainly accounts for the high percentage of the yearly catch *per* fisherman in the Madras Province. Some of the important fishing sites in the South Kanara district (west coast of Madras Province) i.e. Malpe, Bokapatnam, Calicut and Tanur are near Bhatkal, the southernmost point of the Bombay Province. Malpe, Bokapatnam and Tanur are about 43, 78 and 200 miles respectively from Bhatkal. There is no reason why fish from these ports in the Madras Province cannot be brought to Bombay, as the possibility of the transport of fish in a fresh condition from Bhatkal to Bombay has effectively been demonstrated. The *sine qua non*, however, is larger launches, equipped with higher powered engines, a small refrigeration plant and insulated fish holds.

The use of launches has not been an unmixed blessing. Their operation has, to some extent, affected the prosperity of the fish curing yards, of which there are 32 under the control of the Fisheries Section. While the launches have undoubtedly helped to increase the supply of fish in the Bombay markets, they have correspondingly diminished the quantity available for consumption in the areas from which it is brought. The small quantities of fish that find their way to the fish curing yards have still further been reduced by the despatch of fish, in a fresh condition, by bus and rail, to places in the interior where formerly it was not available and where there is a regular demand for it. The diminution in the supply to the fish curing yards has also affected the fish curing industry. This is amply borne out by the reduced quantities of salt sold at the fish curing yards (*vide* Appendix 3). Whereas the sales of salt in 1935-6 amounted to about 80,000 mds. they declined in 1936-7, 1937-8 and 1938-9 to 56,000, 60,000 and 62,000 mds. respectively. Moreover, people on the Ratnagiri and Kanara coast who used to consume fresh fish are now complaining of diminished supplies and exorbitant prices.

The improvement now effected in methods of transport by the use of launches will not alone enable the fishing trade to take its place as one of the major industries of the country. Increase in the supply to Bombay has been effected by depriving the fish curing yards and the coastal population of their former supplies. If success in the use of launches as carriers is to be unqualified, then fish *must be caught in much more abundant quantities than now*. The launches have at present to make distant voyages to obtain supplies of fish. (Fishing fields situated at Ratnagiri and beyond, up to Bhatkal, are on average visited four times per month). Not infrequently the launches have to remain for days on end at the fishing fields, waiting for a big haul before returning to Bombay. The larger catches on the Konkan coast are due less to the efforts of the fishermen than to the fact that fish move in abundant shoals towards the coast, where they are caught with the *Rapan* nets. If shoals do not come in or are not sighted, the fishermen conclude that no fish is available and they declare the season to be a failure. Actually, so often happens, the shoals may not approach near enough inshore to be caught with *Rapan* nets, which can only be worked from the shore. Launches, however, if operated in conjunction with improved types of nets, will be able to pursue shoals which are at present missed because sailing boats cannot keep pace with them.

SEASONS AND STATISTICS.

6. It is a well-known fact that the fishing season starts more or less simultaneously at all fishing centres in the Bombay Province, i.e., immediately after the conclusion of the monsoon. The city of Bombay obtains the bulk of its supply of fish in September and October from the fishing fields situated in the vicinity of Bombay, especially in the north. The fish caught here consists almost exclusively of pomfrets. The presence of pomfrets entirely removes whatever demand there may be for such fish as *wagti, mandil, dhoma, prawns, plaice,* etc., which, meeting with scarcely any demand in Bombay, are taken for disposal to villages adjacent to the area where they are caught. They are there dried or converted into fish manure. Pomfrets at the height of the season fetch from Re. 1 to Rs. 3 per score at the landing sites. The demand for such prime fish as *pala, bhing, surmai, kuppa, black pomfrets* is also insignificant during the pomfret season. The period when catches of pomfret are greatest in the vicinity of Bombay is from about the second week of September to about

the middle of November. Catches are heaviest usually at and shortly after the spring tides of the first half of the lunar month and diminish during and after the spring tides of the second half.

Shoals of pomfrets gradually diminish after November, after which there is a progressive decline in the quantity of fish caught. The pomfret season by this time is practically at an end and very small quantities are landed, and on account of their obvious scarcity, they realize Rs. 8 to Rs. 10 per score. *Ghols, pala, rawas, surmai,* etc., now appear in small quantities and in the absence of pomfrets are in great demand. This period of reduced catches, when markets are barren of fish, lasts about three months (15th November to 15th February) when any indifferent variety of fish obtains a price that is out of proportion to its normal value. The fall in the supply is not marked by a corresponding slackening in the demand, which is uniformly constant throughout the year. An increase in the supply of about 50 per cent during the period will present no difficulty in disposal.

A revival of fishing activities is again noticeable in March and this continues up to May. *Ghol, black pomfret, dara, surmai,* and *bhing* predominate among the fish caught. *Ghol* are available at Rs. 10 per 20, aggregating 400 lb. *Dara* is exclusively available in the area north of Palghar, whence it is dispatched to Bombay. The month of March really marks the commencement of a second fishing season on our coast, which is not, however, as brisk as the pomfret season. It is estimated that at this period an addition of about 30-40 per cent to the available supply could be absorbed easily by the consuming public in Bombay.

Supply from local sources is, of course, practically non-existent during the monsoon, when the public contents itself with supplies from Karachi and such small quantities as the labours of the local fishermen can produce in spite of the handicaps of the inclement weather.

Conditions in the south of the Province, i.e., on the Konkan and Kanara coast, are not entirely dissimilar. Here, too, as in the north, September marks the start of the fishing season, which in some years reaches its height in October, in others, in November and then at times in these very months precipitously drops almost to the level at the start of the season.

A graph (Appendix 3) which is appended to this note bears out the statement made above. The graph shows the quantities of salt issued to the fish curing yards. On the basis of the sales of salt, it is possible to arrive at some idea of the quantity of fish landed, as on an average, one maund of salt is issued to cure about four maunds of fish (1:4).

A reference to the graph will show that the quantity of salt issued in June, July and August is practically on the border line, and that it gradually takes an upward curve in September and October, reaching its peak in November, after which it falls almost abruptly in December to its initial level. Further, it will be noted that the quantity of salt issued in October and November not only equals the aggregate amount of salt issued during the year but also at times, as a matter of fact, exceeds it. Similarly, these months see by far the biggest quantity of fish caught. The supplies in other months are limited and scarcely equal the entire total catch in October and November. The fishing season on the Konkan and Kanara coasts is at its ebb in February, from when onwards there is a progressive decline in the quantities landed. This does not mean that fish is not available, but that the fish at this time of the year migrate into deeper waters, where the fishermen do not venture at present on account of their frail, deckless fishing craft and the small sized fishing gear used.

The termination of the fishing season on the Ratnagiri and Kanara coast in March coincides with the beginning of the fishing season off Palghar, Damaun and Diu (Kathiawar coast) in the north and Harnai, Shrivardhan, Murud, Janjira, Mazagaon and Nandgaon in the south. This season lasts up to the end of May, the bulk of the catch off the Kathiawar coastal area being white pomfrets and in the Janjira area black pomfrets. These are noted for their size and ensure for Bombay a supply of such fish as the Bombay public welcomes.

In September the operation of the launches is confined almost exclusively to the north of Bombay. They then take the utmost advantage of the short fishing season there, and the large quantities of white pomfrets available close by. As the end of the season approaches the launches move south to the Konkan and Kanara coasts, after which, in February, their sphere of operation is transferred to Damaun and Diu in the north and the Janjira area in the south. Though the field of operations is wide, the total annual catch transported by the launches is comparatively trivial and is not at all proportionate to the haul that one might have expected from so extensive a coast-line as that of the Bombay Province. Bombay's supply of fish is thus precarious for the major portion of the year and whatever semblance of steadiness it possesses is due mainly to the launches, which to a considerable extent make up the deficiency of supply that existed formerly. They can shift their sphere of operations to the particular area, anywhere on the coast, where supplies of fish may be large for the time being.

The type of work done by the launches is best illustrated by a representative example. For this purpose the *Lord Brabourne* has been selected and the relevant information is furnished in Appendix 4.

The total quantity of fish landed by the launches since the inception of the experiment and the types of fish brought to Bombay are enumerated in Appendices 5 and 6. Appendix 6 shows that mackerel (*Scomber macrolepidotus*) ranks first in point of quantity. The fish is popularly known throughout the Bombay coast by its vernacular name '*bangda*'. It has a high food value, and is noted for its nutritiveness and easy digestibility. Special reference is made to the mackerel as it is usually scarce in Bombay waters. The small supply of the fish which previously found its way into the

Bombay markets was due not so much to the enterprise of the fishermen, as to the fact that the shoals had somehow strayed from their usual migratory course. In early winter, i.e. from the end of September up to the middle of December, immense shoals of mackerel seek our coasts, where they assemble from their mysterious wanderings at sea. Thousands of fishermen all along the west coasts of both the Bombay and the Madras Presidencies depend for their livelihood on catches of this fish.

Prior to the introduction of the launches, owing to the meagreness of the demand at the fishing sites, a minute fraction of the large quantities caught was consumed fresh *on the spot*. The bulk of the catch, which was sold at a very trivial price, used to find its way to the fish curing yards, where it was cured and salted to be exported long afterwards for sale in Bombay and other places, while a considerable quantity was converted into fish manure. As a result, a first-class product was reduced to a third-class commodity. Owing to the introduction of rapid long-range power transport, mackerel and other fish are now brought in a fresh condition to Bombay, where they find a ready sale and meet a real demand. Large and rich fishing fields have thus been brought within comparatively easy reach of the city.

Other edible varieties of fish than those specified in the appendix are also available, but are not brought to Bombay. People in Bombay do not usually buy any fish beyond the regular types to which they are accustomed. Such fish as *dhoma, wagti, pedwa, shingala, gegar, mandii* and *musi*, for which there is very little demand in Bombay, are taken by sail boats to the fishing villages for local consumption or for drying. Nevertheless, these despised species are nutritious, and if consumed more largely by the public would greatly benefit our fishermen, who are often at their wit's end to supply the limited types of fish usually demanded by the consuming public. No attempt has, hitherto, been made to make known or popularize the numerous forms of fish available in Bombay markets. This object will have to be kept in the forefront of any programme to promote the fish trade in Bombay.

The report of transport operations would be incomplete without reference to the process of dispatch from the fishing fields to the landing site. No sooner is the fish taken aboard than gutting operations begin. The abdomens of the larger fish such as *dara, gnol, iswan*, etc., are slit open and the viscera from the body cavity are removed and thrown away. The swim-bladders are removed and laid aside for later attention. These are sold in Bombay separately to special traders who deal in them at a rate varying from one to two annas each. They are exported to England and China, where the product is utilized for the manufacture of isinglass. The gutted fish are washed with sea water and stored with their ventral surface downwards, to facilitate the escape of water from the melting crushed ice stuffed into the body cavity. Pomfrets, mackerel and other small sized fish are not gutted; they are simply stored in ice in the holds. In storage, great care is taken, however, to ensure that fish do not come into direct contact with the sides of the vessel as the heat transmitted from the sea outside causes softening of the outer layers of fish. Liberal quantities of crushed ice are sprinkled on the bottom and along the sides of the holds. The bottom of the hold is spread over with ice to a thickness of about 6 to 8 inches. A layer of fish is spread out on the ice. Fish and ice are then arranged in alternate layers. Usually one pound of ice is allowed for each pound of fish for a five-day voyage. The ice cools the fish to 32° F and this temperature is maintained throughout the voyage. The larger launches carry, per voyage, on an average, about seven tons of ice. This ensures the perfect freshness of the fish for about five days. Fish cargoes are landed at Sassoon Dock, which is also extensively used by a large number of sailing craft to land their catches.

ADVANTAGES OF POWER-PROPELLED BOATS.

7. (*a*) *Cost of upkeep of launches.*

The initial expenditure in respect of a launch is heavy owing chiefly to the cost of construction of the vessel and the purchase and installation of the engine. Recurring expenditure is, however, not excessive, representing mainly the purchase of oil, stores and overhauling (*vide* Appendix 7). The expenditure under the different heads is not as excessive as it seems, and is more than made good by the increased number of voyages, and the greater certainty of bringing large catches of fish to the city, and by the greater loads they carry. Apart from the saving in time comparatively much less labour is also employed in bringing fish from the fishing sites. A carrier sail boat has to employ about eight men, and is further assisted by two to four men in small tonies stationed on the fishing grounds. These tonies take over the catches from the fishing boats and transfer them to the carrier sail boats.

A launch, on the other hand, is able to get alongside a fishing boat with greater facility and rapidity than a sailing boat doing it. Fishing boats which have contracted to supply their catch to a particular launch, fly flags to differentiate them, at sight, from other fishing boats fishing in the same locality.

(*b*) *Greater cruising radius.*

The greater cruising radius of the launches is their most important advantage. Fishermen do not at present fish beyond a radius of about 15 miles. Owing to the distance to be traversed there is the fear that the fish may deteriorate by the time it is brought ashore. Apart from their rapidity of transport, the wider operations of the launches will encourage the fishermen to venture beyond their present limited region of activity, as they have the certain prospect of their fish being landed with scarcely any risk of deterioration. Moreover, fish brought by launches is more readily saleable, as there is a better demand for it. The prices realized from the sale of fish transported by the launches are higher than those obtained for fish brought by carrier sail boats.

Experience has shown that fish brought from distant landing sites, even from a distance of 300 miles, by the launches is superior in quality to the fish caught in close proximity to Bombay and even to fish brought by train from Bhyandar, Virar, and other stations on the B.B. & C.I. Railway, or by steamer and rail from Veraval and Jamnagar, or by steamer from Karachi and by sail boats from Diu. The reason is that fish transported by rail and sail boats is usually caught about 10 to 15 miles off shore and conveyed in open sail boats which lack storage and other facilities, with the result that it deteriorates considerably in quality on its way to the landing site. The fish is now auctioned and several hours must elapse before the consignment is iced, packed and taken to the railway station for dispatch to Bombay. A few hours more are taken up by the journey, and further time elapses before it is unpacked and auctioned to retail vendors and eventually put up for sale in the Bombay market. It is estimated than on an average at least 20 to 25 hours, if not more, elapse between the time fish is caught at the fishing site and the time it is put up for sale in Bombay. Fish brought from Karachi and Diu takes much longer before it is put on the market counters. There is no such inordinate delay with fish brought by the launches. The catch is placed in ice as soon as it is caught and is transported under specially conditioned means, i.e. properly protected fish holds and insulated boxes. The cargo is never exposed to the sun and is not handled so frequently as fish brought by steamer, rail and sail boat.

Fishermen who formerly patiently waited the return of sailing craft, now eagerly look forward to the more punctual arrival of the launches which bring fish in a more fresh and wholesome condition, yielding them greater profits.

(c) *Benefit to Trade and Other Interests.*

Apart from augmenting the city's supply of fish, the improvement in methods of transport has also led to an improvement in the economic condition of the fishermen working in areas formerly outside the reach of the city's markets. No longer dependent on a fitful and scanty demand, they now not only secure a profitable outlet for the catches but also obtain a better price for their fish. Prior to the visits of the launches to their grounds 1,000 mackerel (approximately 200 lb.) would fetch about Rs. 2, but the identical quantity now yields on an average about Rs. 7, and sometimes as much as Rs. 13 when catches are small and the general demand for fish in Bombay is great. Compared with their conditions prior to the visits of the launches to their ports, this is an immense gain to the fishermen, the capital value of whose catches has been advanced beyond all proportions.

Effective transport has also tended to increase activity at the fishing sites particularly in the southern parts of the coast of our province. The system of payments in ready cash introduced by the launch owners has even tempted fishermen of the Madras Presidency to invade our fishing fields. Fishermen from Malpe operated *rapan* nets at Gangavali, Chendia, Kodar and Bingi. Their invasion has led not only to a healthy element of competition but to improvement in fishing methods since it has induced our fishermen at Baitkhol (Karwar) to use the more effective *rapan* nets which were formerly unknown there. There were 15 such nets in use at the close of the fishing season which ended on March 31, 1939. Greater certainty of lucrative sales is also inducing fishermen to strive for big catches, despite the obvious limitations of the primitive fishing gear.

Users of *rapan* nets resorted to an original device to obtain the fullest benefit from the launches. In the *rapan* net (shore seine), which are worked from the shore a shoal of fish is surrounded and dragged shorewards, but not landed. Advantage is now taken of estuaries and creeks, wherever they exist, to keep the fish alive in their natural habitat till the arrival of the launches. Fishermen are thus enabled to demand and obtain their own price for the catch, for if the bid of the first launch owner is below expectation, the catch is not removed from the water but kept there till a remunerative rate is obtained.

Evidence of the benefit conferred on fishermen in Karwar is further furnished by the honorary organizer of Co-operative Societies at Majali. He states in a letter addressed to this office that the visits of the launches to places in Karwar are eagerly looked forward to by the local fishermen, who were grateful to Government for the introduction of the launches. They now take a keener interest than previously in the pursuit of their trade, and feel that a period of prosperity has set in for them. As evidence of this, the honorary organizer reports that the fishermen have now paid in full to their co-operative society dues which had been outstanding for the past four years.

Improved transport has not only benefited inshore fisheries but also fishing in deeper waters such as at Harnai, Shrivardhan, Murud, Janjira, Mazagaon and Nandgaon. On account of the difficulty experienced in landing their catches fresh in Bombay, fishermen from these parts were formerly compelled to leave their own rich fishing grounds and work in closer proximity to the city. They usually migrated towards Bombay in April and May when black pomfrets were in season. This tendency was arrested when the launches started to serve these distant fishing sites. Fishermen (about 40 boats) who had established their temporary base at Sassoon Dock (Bombay) promptly left and returned to their native fishing grounds, having arranged with the launches to take over their catches. This move was beneficial. The assurance that their fish would be expeditiously transported to Bombay has led them to fish for longer hours at night. They now often remain longer at the fishing fields.

Similarly, the extension of the sphere of operations of the launches to Damaun benefited the fishermen there. Prior to the appearance of the launches in those waters the fishermen went out about 20 miles to sea in quest of *dara* and remained at the fishing site for about 10 days at a stretch. To prevent decomposition fish caught were salted at sea. Since the arrival of the launches their catch is taken over immediately and brought to Bombay in a fresh condition. This is an undoubted piece of good fortune to the local fishermen who are now free from the harassing anxiety of curing their fish at sea. The launches now provide both ready custom and also ready cash.

The surplus yields have given more employment to fishermen and fisherwomen and to those who furnish the crew of the launches, not to mention the large number of coolies and motor lorries which are engaged in the transport of a perishable commodity.

Indirect interests, like the Bombay Port Trust, Municipal markets, fuel suppliers and insurance companies have also profited from the large quantities of fish now brought to Bombay.

The example of the benefits accruing to the fishing trade through improved methods of transport has also influenced parallel development in trade other than fisheries. The conversion of sailing craft into power-propelled vessels by the installation of diesel engines has begun to find vogue in other commercial ventures. The Bombay Steam Navigation Company built the *Noor-Jahan* and equipped her with a 50 B.H.P. Diesel engine. She is being used along the coastal ports for the transport of merchandise other than fish. Another private owner built a vessel named *Hilda* equipped with a 25 B.H.P. Diesel engine for the same purpose. Two vessels, the *Takadevi* and the *Mandwa Queen*, equipped with 18 and 36 B.H.P. engines respectively were built by another company for the carriage of passengers between Bombay and Mandwa and intermediary ports. Besides these, there are now other smaller vessels, similarly equipped and used for the transport of passengers. All the above-mentioned vessels were designed and constructed wholly by Indian boat-wrights. A considerable fillip has thus been given to the boat-building industry.

(*d*) *Growth of refrigerating facilities.*

Larger supplies of fish made available by the launches have induced the flow of private capital into channels intimately bound up with the fishing trade. Several ice factories and cold storage plants have sprung up. Two ice factories and cold storage plants have since been set up at Malwan, on the Ratnagiri coast, and Chendia on the Karwar coast. In Bombay quick freezing plant employing the Z-process has been installed by a Russian technician at the Kermani market at De Lisle road (Bombay) and an ice factory and a cold storage plant have been constructed on the east side of the Crawford market (Bombay). A feature of the last plant is that it has a number of small chambers which are hired out at small fees either to one individual or to several collectively. This plant also provides for the quick freezing of fish.

During the current year an ice factory and a quick freezing and storage plant were set up at Sassoon Dock (Bombay) where all the launches, both Government and private, land their catches. This factory and cold storage plant have met a long-felt want and proved an undoubted boon both to fishermen and owners of launches and sailing craft. It has obviated the need of obtaining ice from remote centres in the city, thus saving a good deal of time and expenditure. The existence of the cold storage plant at the Dock is a welcome facility to the fishermen, who are now able to store catches at any hour of the day or night when retail vendors are not on the spot.

The resources and facilities for cold storage are thus brought within the reach of even the most petty trader. The establishment of ice factories and quick freezing plants provides striking evidence of the increasing realization by the public of the importance of the fish trade as an avenue for the investment of capital. Another advantage is that fish caught when supplies are plentiful can be stored fresh for ready sale to the public in the monsoon when supplies are low and the demand has to be met to a large extent by imports of indifferent quality from Karachi.

All the capital for the ice factory and cold storage plant, amounting to over Rs. 5,00,000, has been furnished by private enterprise.

Apprentice Scheme.

8. One of the most conspicuous features of the scheme is the opening out of a new avenue of employment to youths of the fishing community. An important consideration was to train youths as mechanics to operate the launches. With this end in view an apprenticeship scheme was started. Lads from the fishing community are now being trained in the operation and maintenance of motor launches to enable them to take charge of their own launches. The number of apprentices so far trained is 17 of whom six have passed the examination and obtained the necessary certificate from the mercantile marine department. These boys have been in regular employment on Government launches ever since they successfully qualified at their examination. The work of the apprentices has been quite satisfactory. They have shown constant zeal and devotion to duty. Besides improving their material prospects, the scheme has thus also served to open a new sphere of employment to the fishing community. Experience has shown that the work of a mechanic aboard a fishing vessel is extremely arduous and fatiguing, and calls for great powers of endurance. Machanics recruited from classes other than the fishing community are not able to stand up to the strain of continuous service at sea.

Conclusion.

9. The foregoing makes it clear that the objects underlying Government's experiments, namely, the popularization, by actual demonstration, of launches for the transport of fish and an increase in the city's supply of fish, have been amply fulfilled (*vide* Appendix 5). The increase in supplies is undoubted and is forcefully borne out by a comparison with the figures quoted by Dr. H. T. Sorley, in his report on the *Marine Fisheries of the Bombay Presidency*. His survey disclosed that the city's supply of fish annually amounted to 10,000 tons. The latest statistics show that the fish brought by the launches to Bombay during a short fishing season in

1938-39 totals about 700 tons over and above Dr. Sorley's figures. The city's supply of fish has thus been increased by about seven per cent in five years which, in view of the inveterate prejudices and ingrained conservatism of the fishermen to any reforms, is no small achievement.

As far as direct increase in supply is concerned the experiment with launches for the transport of fish in our waters has been more successful than the experiment with the trawler *William Carrick*, which the Government of Bombay brought out in 1923. In 36 voyages, over a period of nine months, this vessel caught 188,138 lb. of fish, of which 152,875 lb. were landed for sale in Bombay, the remainder being disposed of at Karachi. The entire sale proceeds amounted to Rs. 19,350. One of the launches during seven months of the fishing season of 1938-39 brought to Bombay 453,943 lbs. of fish, which realized an aggregate of Rs. 34,683.

The work of the launch differs in one respect from that of the trawler, for while the former merely transports, the latter also catches fish. The comparison, however, has its point in one important respect. Fish landed either by launch or trawler would, in the normal course of events, never have found its way to the Bombay markets. These results indicate that launches are, at present, more remunerative than trawlers and that under existing conditions even their bare use as carriers, is productive of better results. It is not suggested that there is no scope for trawling in our waters. Prevailing conditions indicate that the introduction of trawlers would at the moment be premature. Trawling must follow an intensive study and exploration of the field. We must know a great deal more about the movements and periodicity of fish in our local waters before we launch on such a costly enterprise. Trawling is bound to be hampered by certain inherent defects peculiar to our type of fisheries. I do not intend to suggest that I am opposed to trawling, which is indeed an invaluable and effective method of ensuring big catches, but there seems to be an erroneous belief that trawling is an 'open sesame' that will at once unlock to our fishermen the treasures of the deep.

The view that increased supplies are synonymous with 'trawling' is borne out by the examples of the Bengal, Madras and Bombay administrations, all of which have at some time or the other, invested in trawlers as a means of augmenting supplies. This view is founded on the mistaken belief that a trawler rakes in every form of life below or on the surface of the water in which it is operated. This is not so. A trawler operates on the floor of the sea bed, and the upper levels of the sea abounding with valuable surface forms entirely escape the trawl. That valuable fisheries can be established and maintained without trawlers has not at all been realized in this country.

Trawling is but an advanced, though expensive, stage of fisheries and should be resorted to only after exhaustive exploitation of other cheaper and less elaborate methods, none of which have ever been considered worthy of trial in our waters. A method extensively employed both on the Asiatic and American sea-boards of the

Pacific Ocean is the 'Purse seine'. Fishing by the purse-seine is not only economic but also yields large catches. Pelagic fish, according to present conditions, are ultimately the most remunerative products of the sea. We must turn our attention to our most remunerative harvests, the shoals of pelagic species such as *mackerel, sardine, pedwa, pomfrets, pala, bhing* which command an instant market. The purse-seine is one of the most effective types of net for the capture of these pelagic forms and can be adapted most conveniently to our requirements. The 'purse-seine' is not unlike our native '*rapan*', on which it may be considered an improvement. The working principle of the '*rapan*' and the 'purse-seine' is identical, with this difference that the former is operated from the shore, and dependent therefore on the appearance of shoals of fish in the relatively shallow waters of our harbours and estuaries while the latter is employed at sea, being designed for the capture of shoals moving in deeper waters. The 'purse-seine', whose measurements range from 200 to 400 fathoms in length and 30 to 50 fathoms in depth would be ideal for use off the North and South Kanara coast, where immense shoals of sardines and mackerel appear annually. Its use would bring about a decided change for the better in the development of our fisheries.

The Gill net (drift net), with different sized meshes for the capture of different varieties of fishes, equally offers promise of good results. Gill nets are not unknown in our waters. They are, however, comparatively small, measuring, as a rule, half-a-mile in length and usually about 12 feet in width, whereas gill nets in use in Europe and America are over three miles long and 40 feet wide. The dimensions of the Indian net must of needs be smaller as they are worked by man-power, whereas in Europe and America vessels are equipped with special power-driven machinery to lift the extensive stretches of net. A gill net is really a wall of netting hanging vertically in the water, set either to capture fish moving about in the regions nearer the surface or sunk low enough to capture those which swim at deeper levels.

Another useful net which may be used with success in our waters is the 'Danish seine', which is a simpler and cheaper form of the trawl. A recommendation for the introduction of this net in our waters was put forward by Mr. A. E. Hefford, in his report on the work of the Steam Trawler '*William Carrick*'. He gives a detailed description of the 'Danish seine' and its potentialities. The 'Danish seine' is capable of catching as much fish, and not infrequently more than a trawl net. The initial cost of equipping a vessel with a 'Danish seine' is only one-fourth of the cost of fitting out a steam trawler, and a vessel capable of working this gear can be built and completely equipped at about one-tenth of the cost of a steam trawler, while the crew is about half that required for a trawler.

Bombay is in a singularly fortunate position for the introduction of improved types of nets. The operation of the launches has conclusively shown that fish may be transported in excellent condition from anywhere on our extensive coast line to Bombay. The adaptation of launches for actual fishing, besides their present use as carriers, would imply a further and considerable advance in the economic status of the fishermen, for the use of power-propelled vessels, together with new contrivances for fishing, cannot but render the calling of fishermen more fruitful. It will free them from their utter dependence on the elements, will extend their limited sphere of their operations and provide results which cannot be expected from the primitive type of craft and tackle now in use.

The Province of Bombay is constantly faced with the problem of supplying fish to that large section of its population with whom it forms a regular item of diet. That section would considerably increase if fish were made available in quantities which would ensure cheapness of price. If the city of Bombay, with its transport and marketing facilities, is deficient of supplies the mofussil towns are even more so. There is no reason for the continuance of these conditions, particularly in a maritime Province whose extensive sea-board is abundantly stocked with fish, equal in many instances in food and sale values to the best obtainable in any part of the world. The present supplies are not only far below the potential but even below the actual demand. Adjustment of supplies to demand is our problem.

Apart from meeting the market demand, increased supplies of fish will also lead to the establishment of several profitable ancillary industries, such as manure, fish meal, fish guano, fish maws and the manufacture of fish oil, and fish glue. The Bombay Province, despite its extensive sea-board, cannot boast of a single factory for the manufacture of these useful, saleable products. The demand is great, but the scarcity of raw material renders their manufacture impossible. In this respect Bombay lags far behind the Madras Presidency, which during 1936-37 had 103 factories for the manufacture of manure by-products, and during 1927-28 produced 100,000 tons of fish guano, valued at about Rs. 70,00,000. As against this the fish annually caught in the Bombay Province including Sind averages 50,000 tons and realizes only Rs. 80,00,000 as a primary product.

Other activities which will be stimulated by an increased yield of fish will be the rope-making industry, the manufacture of nets, and boat-building. There will also be the demand for an increased output of ice. Larger numbers of women and men will be needed to handle increased catches. More work will be provided for coopers, hawkers, ice vendors, packers and so on, the bulk of whom will be recruited from the fishing community.

What efficient methods can do for the welfare of the fishing communities is well illustrated by the example of Japan. This country in 1919 had a fishing fleet of 3,933 power-propelled vessels, which by 1936 rose to 62,169. Japan's progress has been phenomenal. As in Bombay, the industry in Japan was first dependent entirely on sailing craft. It was only after the replacement of sailing craft by power-propelled vessels that the fishing industry was entirely transformed and came to occupy a leading place in the nation's economy. With a coast line less than that of India and many European countries, Japan now occupies a rank in the forefront of the world's fisheries. Sailing vessels there are being gradually replaced by power-propelled vessels equipped with every modern facility for catching fish and preparing it for the market by freezing, treating and canning it aboard. The number of sailing boats declined from 380,577 in 1919 to 308,541 in 1935.

The explorations of our coastal waters by the 'Investigator' and the work of the various trawlers that have from time to time been employed by the Provincial Governments, and the investigations of the recent John Murray Expedition to the Indian Ocean, conclusively show that the Arabian Sea is as prolific of life as the North Atlantic Ocean or the English Channel. There is no reason, therefore, why analogous results, proportionate to the resources available, should not be achieved in Bombay.

No review of the progress of the work carried out by the fisheries section will be complete without a reference to yet another serious handicap from which the fishing industry in Bombay now suffers, i.e. the lack of a regular fishing dock equipped with contrivances used in leading fishing ports elsewhere in the world, for the expeditious landing and conveyance of catches to the various consuming centres, both retail and wholesale.

Efforts to develop and modernize our fishing industry are now hampered by difficulties arising from the want of adequate port facilities. The absence of a suitable landing site or sites for fish in Bombay adversely affects the quick landing and dispatch of fish to the markets in the city. Their provision is fundamental to any attempt to improve and develop the fishing trade. Our fishing craft should be able to leave or enter port at any stage of the tide. Under the conditions prevailing fishing vessels, both launches and sailing craft, are unable to leave and enter port when the tide is out. The result is that the owners of these vessels not infrequently miss the busiest and most lucrative hour in the market. Both the quality of the catch and prices are thus adversely affected. Further, the serious extent to which the lack of efficient docking facilities interferes with the movements of the fishing vessels, especially the launches, is not generally realized. They cannot be loaded with ice, Diesel oil, or other necessary material so long as they rest on the floor of the basin. This reduces the effectiveness of power vessels, and involves loss of time and the consequent curtailment of voyages performed during the season.

Even places where fish have been traditionally landed have no special facilities for unloading catches at low tide when fishermen have to run up and down between the boats and the shore, carrying their loads on their heads. These drawbacks can only be overcome by the provision of better docking facilities. The increased use of launches on our coast has brought this problem to the forefront. If power transport is to prove the success it is designed to be, it is imperative that the provision of adequate docking facilities be not delayed any longer.

APPENDIX I

No.	Name of the launch	Year of construction	Tonnage and cost of complete vessel	Engine B. H. P. and speed	Name of owner	Remarks
1	Shelmari	1933 24 ft. in length	Not known Rs. 3,500 Engine 2,200 Hull 1,300	10 B.H.P. Diesel Engine (Kromhout). 6 knots	Messrs. Patil & Bhika	Originally belonged to the Burmah Shell Oil Co. Ltd., who converted a fishing craft into a power propelled boat.
2	Original 'Lady Sykes'	Not known	Not known Rs. 1,900	14 B.H.P. Petrol Engine. 6·6 knots	R.I.N.	Borrowed from the R.I.N. for demonstration purposes. Returned in 1934.
3	'Lady Sykes'	1934 35′ × 10′ × 4′ – 9″	4·17 Rs. 13,000 Engine 5,450 Hull and other equipment 7,550	28·5 B.H.P. Diesel Engine (Gardner) 7·24 knots	Department of Industries.	Sold on hire purchase system to Messrs. Patil & Bhika. Built at Messrs. Alcock Ashdown & Co.
4	'Sir Frederick Sykes'	1934 35′ × 10′ × 4′ – 9″	4·93 Rs. 12,600 Engine 5,640 Hull and other equipment 6,690	38 B.H.P. Diesel Engine (Lister) 8·34 knots.	Do.	Do. do.
5	'Hydari'	1934	6·06 Rs. 8,000	25 B.H.P. Diesel Krupp Engine	Messrs. Hamid & Co.	...

6	'Lady Brabourne'	1936 42′ × 11′ × 5′ – 3″	8·99 Rs. 19,800 Engine 9,950 Hull and other equipment 9,850	52 B.H.P. Diesel Engine (Ruston Lister) 8·32 knots.	Department of Industries	Sold on hire purchase system to Messrs. Jagannath S. Parkar & Co. Built at Messrs. Alcock Ashdown & Co.
7	'Cymbria'	Not known	Not known Rs. 40,000	90 B.H.P. Diesel Not known	Messrs. Hamid & Co., Bombay	Old trawler brought out by Mr. P. Schulze. It was converted into a fish carrier in 1936–37. She grounded off the rocks at Colaba and became a total wreck in 1938.
8	'Lord Brabourne'	1937 45′ × 11′ × 5′ – 6″	7·83 Rs. 23,000 Engine 9,815 Hull and other equipment 13,185	57 B.H.P. Diesel Engine Gardner (with insulated hold) 8·23	Department of Industries	Sold on hire purchase system to Messrs. Jagannath S. Parker & Co. Built at R. I. N. Dockyard.
9	'Chandtara'	1937 46′ – 9″ × $10\frac{1}{2}$′ × 8′	14 Rs. 18,000 Engine 12,000 Hull and other equipment 6,000	52 B.H.P. (Ruston Hornsby) Not known	Mr. Abubakar Hussein Saheb Thakur	Built at Vijaydurg.
10	'Nooremohomedi'	1938	Not known Rs. 22,000 Engine 14,000 Hull etc. 8,000	70 B.H.P. Engine (Ruston Hornsby) Not known	Do.	Built at Bassein.

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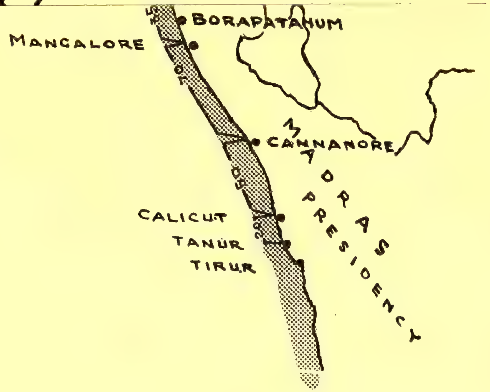
8	'Lord Brabourne'	1937 45′ × 11′ × 5′ – 6″	7·83 Rs. 23,000 Engine 9,815 Hull and other equipment 13,185	57 B.H.P. Diesel Engine Gardner (with insulated hold) 8·23	Department of Industries	Sold on hire purchase system to Messrs. Jagannath S. Parker & Co. Built at R. I. N. Dockyard.
9	'Chandtara'	1937 46′ – 9″ × 10½′ × 8′	14 Rs. 18,000 Engine 12,000 Hull and other equipment 6,000	52 B.H.P. (Ruston Hornsby) Not known	Mr. Abubakar Hussein Saheb Thakur	Built at Vijaydurg.
10	'Nooremohomedi'	1938	Not known Rs. 22,000 Engine 14,000 Hull etc. 8,000	70 B.H.P. Engine (Ruston Hornsby) Not known	Do.	Built at Bassein.

APPENDIX I—(*contd.*)

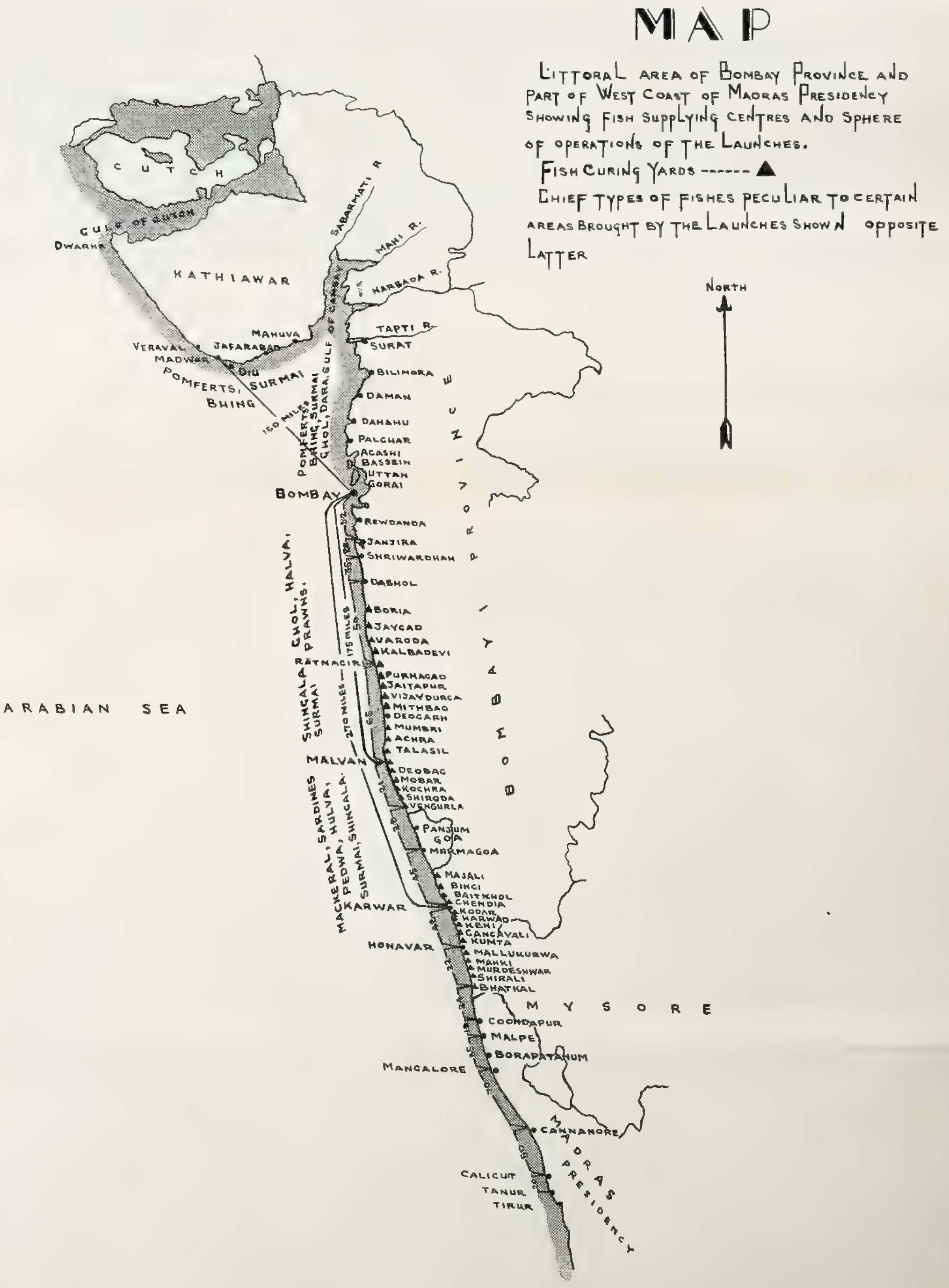
No.	Name of the launch	Year of construction	Tonnage and cost of complete vessel	Engine B. H. P and speed	Name of owner	Remarks
11	' Karimi '	1939 45′ × 12′ × 6′	Not known Rs. 13,000 Engine 7,000 Hull and other equipment 6,000	40 B.H.P. (R. Hornsby) Not known	Janjira Fishing Co.	Built at Billimora.
12	' Sea Hawk '	...	...	...	...	Built at Billimora. She was temporarily put into service at the time ' Karimi ' was under construction.
13	' Khajahind '	1939 56′ × 13′ × 6′	Not known Rs. 30,000 Engine 20,000 Hull and other equipment 10,000	M.W.M. 140 B.H.P.	Abubakar Hussein Thakur	Built at Vijaydurg.

Appendix 7


BORAPATAHUM
MANGALORE
CANNANORE
MADRAS
PRESIDENCY
CALICUT
TANUR
TIRUR

Department of Industries
BOMBAY.
23-6-39

Appendix 2



MAP

Littoral area of Bombay Province and part of West Coast of Madras Presidency showing fish supplying centres and sphere of operations of the Launches.

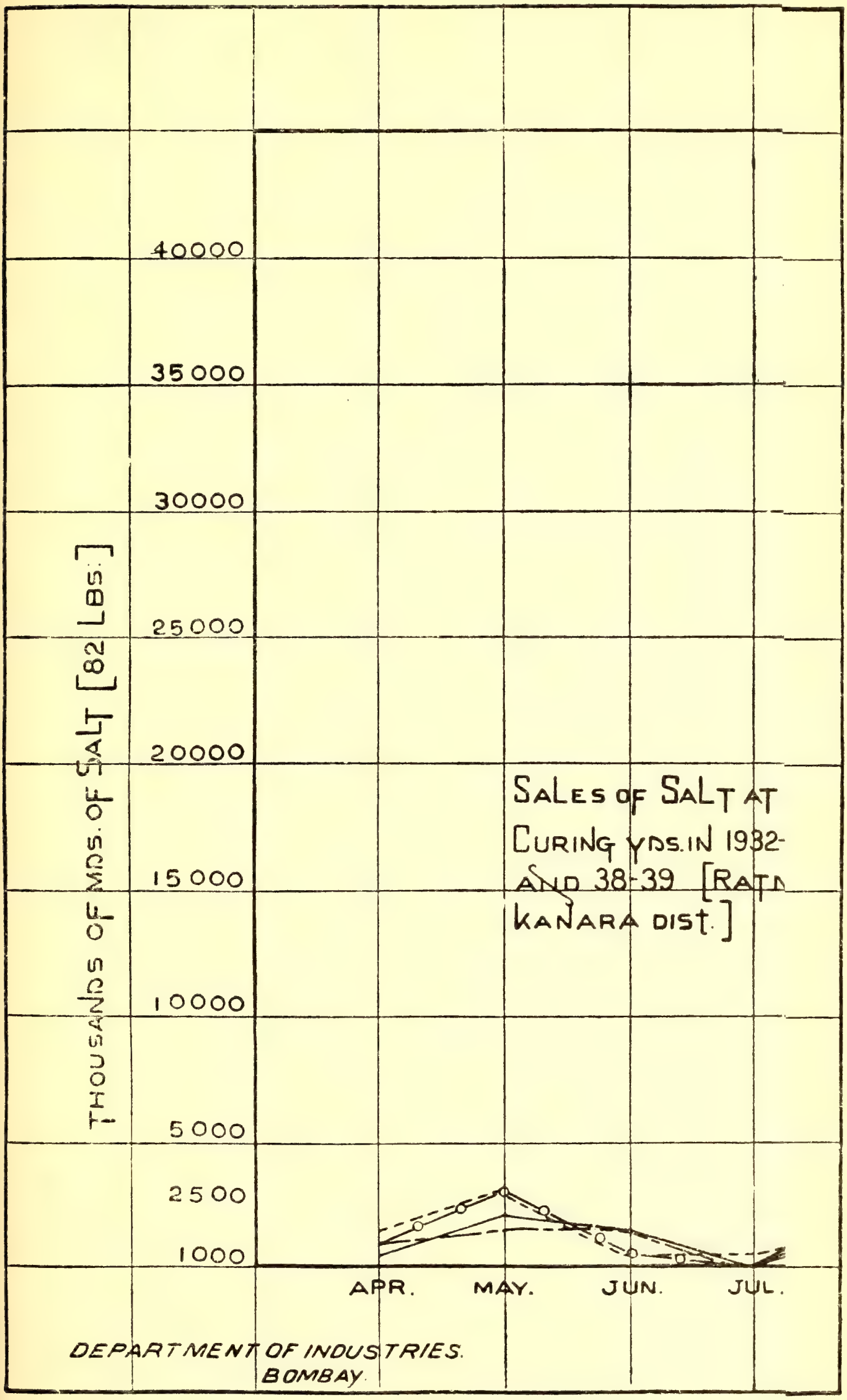
Fish Curing Yards ------ ▲

Chief types of fishes peculiar to certain areas brought by the Launches shown opposite latter

North
CUTCH
GULF OF CUTCH
DWARKA
KATHIAWAR
SABARMATI R.
MAHI R.
NARBADA R.
GULF OF CAMBAY
TAPTI R.
MAHUVA
JAFARABAD
VERAVAL
MADWAR
DIU
SURAT
BILIMORA
DAMAN
DAHANU
PALGHAR
AGASHI
BASSEIN
UTTAN
GORAI
BOMBAY
POMFERTS, SURMAI
BHING
160 MILES
POMFERTS, BHING, SURMAI, GHOL, DARA
REWDANDA
JANJIRA
SHRIWARDHAN
DABHOL
BORIA
JAYGAD
VARODA
KALBADEVI
RATNAGIRI
PURNAGAD
JAITAPUR
VIJAYDURGA
MITHBAO
DEOGARH
MUMBRI
ACHRA
TALASIL
175 MILES
270 MILES
SHINGALA, GHOL, HALVA, SURMAI, PRAWNS.
ARABIAN SEA
MALVAN
DEOBAG
MOBAR
KOCHRA
SHIRODA
VENGURLA
PANJUM
GOA
MARMAGOA
MACKERAL, SARDINES, PEDWA, HULVA, SURMAI, SHINGALA.
MAJALI
BINGI
BAITKHOL
CHENDIA
KARWAR
KODAR
HARWAD
KENI
GANGAVALI
KUMTA
HONAVAR
MALLUKURWA
MANKI
MURDESHWAR
SHIRALI
BHATKAL
MYSORE
COONDAPUR
MALPE
BORAPATAHUM
MANGALORE
CANNANORE
CALICUT
TANUR
TIRUR
BOMBAY PROVINCE
MADRAS PRESIDENCY

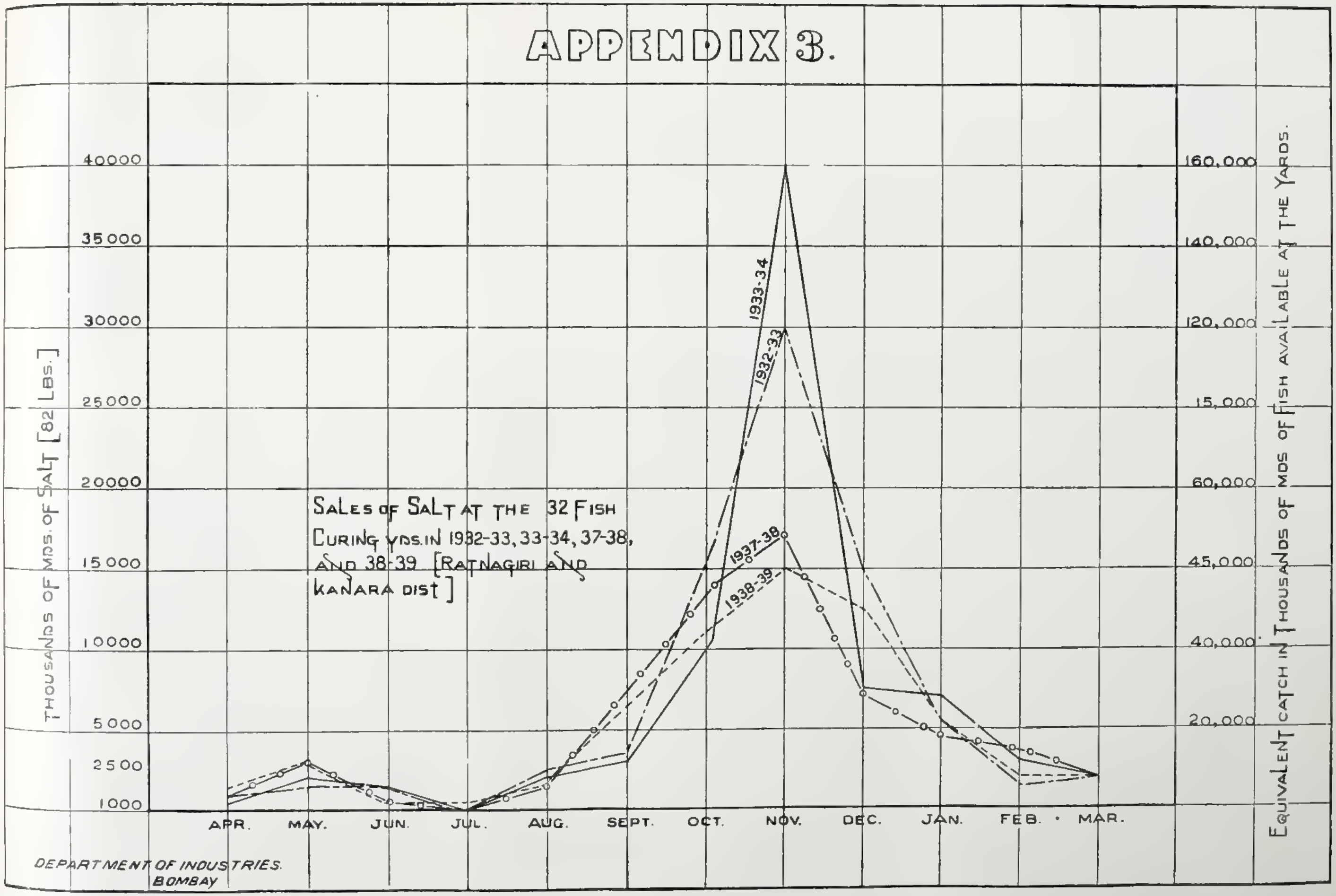
Department of Industries
Bombay,
23-6-39

S. B



Sales of salt at the fish curing

APPENDIX 3.



Sales of salt at the fish curing yards and the equivalent in thousands of maunds of Fish available at these yards.

APPENDIX 4

' LORD BRABOURNE '

Giving details of the number of voyages made by the vessel, its destination, wt. of fish transported, the number of miles covered on each voyage and the total number of working hours.

No. of voyages	Date of arrival in Bombay	Wt. of fish transported in lb.	Name of fishing site	Total mileage done on voyage (approximate)	Total No. of working hours (approximate)	Remarks
1	9-4-38	3,580	Devgad	810	84-15	
2	10-4-38	1,735	Janjira	100	11-40	
3	11-4-38	494	Do.	100	12-35	
4	16-4-38	11,885	Dahanu	120	35-30	
5	19-4-38	No fish	Murud and Nandgaon	110	12-55	On account of rough sea no fish available.
6	27-4-38	2,026	Devgad	383	48-10	
7	28-4-38	2,668	Janjira	120	12-40	
8	29-4-38	1,291	Nandgaon	110	12-30	
9	2-5-38	837	Hernai	144	30-45	
10	4-5-38	112	Revdanda	64	16-55	
11	5-5-38	3,530	Nandgaon	110	12- 0	
12	7-5-38	4,150	Do.	110	21-35	
13	8-5-38	683	Shrivardhan	140	16- 0	
14	10-5-38	1,820	Revdanda	32	15- 0	
15	17-5-38	455	Shrivardhan	140	16-45	
16	18-5-38	2,800	Do.	140	16-55	
17	19-5-38	1,645	Do.	140	16-45	
18	20-5-38	6,450	Do.	140	16-25	
19	21-5-38	2,800	Do.	140	16-15	
20	22-5-38	560	Do.	140	16-55	
21		990	Shrivardhan	140	16- 0	
22	3- 7-38	675	Dharamtar	21	5- 0	
23	4- 7-38	803	Do.	21	5- 0	
24	5- 7-38	1,530	Do.	21	5-10	
25	6- 7-38	1,080	Do.	21	4-30	
26	7- 7-38	195	Do.	21	4-45	
27	9 7-38	290	Do.	21	5- 0	
28	14- 7-38	341	Do.	21	4- 0	
29	16- 7-38	1,000	Do.	21	4-10	
30	17- 7-38	1,100	Do.	21	5	
31	18- 7-38	725	Do.	21	9	
32	22- 7-38	455	Do.	21	4-15	
33	26- 7-38	290	Do.	21	4- 5	

APPENDIX 4—(*contd.*)

No. of voyage	Date of arrival in Bombay	Wt. of fish transported	Name of fishing site	Total mileage done on voyages (approximately)	Total No. of working hours (approximately)	Remarks
1	5- 9-38	19,800	Devgad ...	380	60-15	
2	11- 9-38	4,730	Ratnagiri ...	333	44	
3	25-10-38	5,710	Malwan ...	456	66-54	
4	17-10-38	3,616	Diu ...	378	56-45	
5	23-10-38	3,700	Malwan ...	422	58-45	She went to Diu and returned empty.
6	28-10-38					
7	2-11-38	12,098	Karwar ...	596	76-15	
8	5-11-38	9,030	Karwar, Majali ...	574	70-15	
9	15-11-38	11,100	Karwar, Bingi ...	570	79-20	
10	20-11-38	16,500	Do.	679	84-30	
11	24-11-38	16,210	Do.	574	75-30	
12	29-11-38	16,900	Karwar, Devgad ...	560	76-15	
13	4-12-38	17,300	Bingi, Karwar and Devgad ...	560	72	
14	8-12-38	16,300	Karwar, Majali ...	565	75-55	
15	12-12-38	16,500	Karwar ...	544	70-45	
16	16-12-38	16,500	Karwar, Bingi ..	569	77	
17	22-12-38	16,000	Karwar, Kajubag ...	544	71-45	
18	28-12-38	15,230	Karwar, Devgad ...	577	73	
19	1-1-39	16,700	Karwar, Bingi ...	561	72	
20	5-1-39	17,000	Karwar ...	664	76	
21	11-1-39	18,300	Karwar, Majali ...	564	74	
22	14-1-39	19,500	Majali, Karwar ...	469	71	
23	19-1-39	18,000	Karwar ...	544	71	
24	24-1-39	18,000	Karwar ...	544	78	
25	1-2-39	11,550	Malwan, Devgad ...	754	98	
26	8-2-39	13,000	Karwar ...	485	67	
27	28-2-39	11,000	Chendia, Bingi and Karwar ...	600	74	
28	11- 3-39	10,000	Karwar	560	69	
29	20- 3-39	9,290	Bilimora	200	62	
30	25- 3-39	3,645	Daman	180	77	
31	28- 3-39	2,620	Shrivardhan	140	15-45	
32	30- 3-39	909	Do.	140	16	
		445,733		19,434	2,689-40	

APPENDIX 5

Statement of amount of fish landed by the launches since the first fishing season after the inception of the experiment.

Name of launch	1933–34	1934–35	1935–36	1936–37	1937–38	1938-39
Shelmari	Figures not available	...	...	...	...	...
Lady Sykes (Original)	2,662	...	...	...	...	...
Lady Sykes	...	91,723	69,840	132,987	81,317	117,542
Sir Frederick Sykes	...	74,402	59,116	52,998	59,842	21,075
Hydari	not available	...	66,740	187,000	122,580	80,793
Cymbria	...	...	...			...
Lady Brabourne	...	...	110,490	218,694	319,637	300,350
Chandtara	...	...	...	...	93,400	243,157
Lord Brabourne	...	...	...	...	67,168	465,733
Nooremohamedi	...	...	...	...	...	270,763
Sea Hawk	...	...	...	...	...	70,555
Karimi	...	...	...	...	...	6,714
B. S. N. Co's steamers	...	154,560	103,260	56,250	...	152,480
	2,662	320,685	409,446	647,929	743,944	1,729,162

Total for five years = 3,384,616* lb.

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* These figures do not include fish brought by the B. S. N. Company's steamers.

APPENDIX 6

Statistics showing the different varieties and quantities of fish (in lb.) brought by the launches during 1938–39

Variety of fish	Names of Launches									
	Lady Brabourne	Lord Brabourne	Sir Frederick Sykes	Lady Sykes	Hydari	Chandtara	Nooremohomadi	Sea Hawk	Karimi	Total
Hulva	46,018	53,912	...	46	...	6,675	...	819	606	108,076
Bhing	5,448	7,010	...	...	...	584	...	25,743	1,409	40,194
Karli	500	900	...	8	...	...	...	...	1,345	2,753
Dara	20,175	22,190	1,875	6,795	...	2,000	...	75	...	53,110
Ghol	295	5,370	...	115	45	...	...	9,755	1,247	16,827
Surmai	831	11,895	...	10	...	1,056	900	992	...	15,684
Khajuri	...	525	...	...	...	...	...	75	...	600
Pomfrets	374	3,836	...	28,534	6,882	3,500	...	2,270	445	45,841
Towar	...	47	...	...	...	...	...	5,420	1,339	6,806
Datali	80	110	...	...	...	...	...	10,884	...	11,074
Dagol	...	105	...	...	...	198	20	...	...	323
Rawas	19	361	...	5	...	...	...	490	323	1,198
Kuppa	...	188	...	...	...	112	...	...	...	300
Boi	...	110	...	...	...	...	...	25	...	135
Mackerel	213,670	332,450	19,200	66,764	63,926	208,750	246,450	...	...	1,151,210
Sardine	10,700	1,600	...	...	...	...	...	...	...	12,300
Kot	60	1,260	...	1,136	20	...	...	240	...	2,716
Prawns	2,000	80	...	1,320	20	...	...	...	...	3,420
Crabs	...	655	...	...	...	...	...	...	...	655
Shingala	...	110	...	...	120	...	...	...	...	230
Ganesh	...	...	...	12,525	...	...	...	...	...	12,525
Small fish	180	3,019	...	284	80	282	2,000	13,767	...	19,612
Total ...	300,350	445,733	21,075	117,542	71,093	223,157	249,370	70,555	6,714	1,505,589

'Sir Frederick Sykes' made only four voyages during the year.

'Sea Hawk' made her first voyage on 11–11–38.

'Karimi' made her first voyage on 27-2-39.

APPENDIX 7

Approximate cost of upkeep and operation of a launch with a carrying capacity of 10,000 to 12,000 lb. of fish and with a 60 B.H.P. engine.

WORKING CHARGES PER MONTH

Details of crew	Wages per month	
	Other communities	Fisherfolk*
One Mechanic ...	Rs. 60 p.m.	Rs. 30 to 40 p.m.
,, Tindal ...	,, 50 ,,	,, 25 to 30 ,,
,, Khalasi ...	,, 30 ,,	,, 15 ,,
Seven crew @ Rs. 15 ...	,, 105 ,,	,, 105 ,,
Total per month ...	,, 245 ,,	,, 175 to 190

Item		RS	A	P
1.	To cost of crew wages	175	0	0
2.	Do. feeding crew	100	0	0
3.	Cost of fuel oil at 160 gallons per voyage and 5 trips per month (160 × 5) = 800 gallons at Rs. 65 per ton.	217	0	0
4.	Cost of lubricating oil at 3 gallons per voyage and 5 voyages per month (3 × 5) = 15 × 2·75 per gallon	41	0	0
5.	Cost of small stores, etc.	20	0	0
6.	Wharfage on ice and oil and basin rent	30	0	0
7.	Do. ice for storing fish during transport to Bombay. Consumption of ice is 5 tons per voyage (cost of ice is Rs. 10 per ton) and 5 voyages per month...	250	0	0
8.	Insurance charges per month at 2½% premium on Rs. 20,000	42	0	0
9.	Interest and Depreciation charges at 6% Interest and 10% Depreciation on Rs. 20,000	267	0	0
10.	Maintenance, storage, painting and repairs ...	67	0	0
	Total working charges per month ...	1,209	0	0

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* These belong to the fishing community and have qualified for their work under the special apprenticeship scheme of this department. They assist in the collection, gutting, icing and storing of fish in the holds and in Bombay in the unloading and sale of fish.

The launches make on an average five voyages per month when they operate between Bombay and the fishing fields off Ratnagiri, Karwar and Daman. Daily voyages are made to the fishing fields which lie off Dharamtar, Revdanda, Alibag, Murud, etc. in the south, and Danda, Versova, Manori, Bhyander, Bassein, etc. in the north.

Tons of fish landed per month for 5 voyages.	= 20 tons.
Average cost of transporting one ton of fish.	= Rs. 60-8-0.
Average cost of transporting one lb. of fish to Bombay from the fishing sites off the Kanara coast.	5 pies.

MEDICINAL AND POISONOUS PLANTS OF INDIA:

Flacourtiads, Pittosporads, Milkworts, Seaheaths, Purslanes, Tamarisks.

BY

J. F. Caius, S.J., F.L.S.

I.

The Flacourtiaceæ are trees or shrubs inhabiting tropical and subtropical regions. They are arranged in 70 genera with about 500 species.

The seeds of some of the members yield fatty oils which are used with some success in the treatment of leprosy and other skin diseases. Narcotic and anthelmintic properties are also found in this Order.

The following have been isolated:—(1) *alcohols*—phytosterols—; (2) *acids*—hydrocyanic, linolic, palmitic, linolenic, isolinolenic, oleic, chaulmoogric, hydnocarpic—; (3) *glucosides*—gynocardin—; (4) *enzymes*—gynocardase—.

The medicinal and poisonous Flacourtiads of the world belong to 14 genera:—Aphloia (South Africa, Madagascar, Mascarenes); Asteriastigma (India); Caloncoba (tropical Africa); Dioncophyllum (tropical Africa); Flacourtia (tropical Asia and Africa); Gynocardia (India); Homalium (Tropics); Hydnocarpus (Indomalayan region); Oncoba (tropical America and Africa; Madagascar); Pangium (Malay Archipelago); Scolopia (warm regions); Taraktogenos (Malaya); Trimeria (Southern and tropical Africa); Xylosma (Tropics).

The medicinal and poisonous Flacourtiads of India belong to 6 genera:—Asteriastigma, Flacourtia, Gynocardia, Hydnocarpus, Pangium, Taraktogenos.

A. Petals absent, disc present; fruit baccate ...	Flacourtia.
B. Petals present, with an adnate scale or basal appendage.	
1. Petals 5.	
a. Sepals connate; stamens very many ...	Gynocardia.
b. Sepals free 5; stamens 5	Hydnocarpus.
2. Petals 5-6; sepals connate in a tube; stamens free 20 to 25	Pangium.
3. Petals 8; sepals free 4; stamens 20 to 30 ...	Taraktogenos.
4. Petals 12-16; sepals imbricate 4; stamens 60-70 ...	Asteriastigma.

Asteriastigma.

The sole species, **Asteriastigma macrocarpa** Bedd., is a large tree found in the sholas or evergreen forests of Mysore, Tinnevelly and Travancore from about 1,000 to 4,000 feet.

The oil from the seeds is believed to be a valuable medicine.

Canarese: Doddasurante—; *English*: Cannonball Tree—; *Malayalam*: Aileyam, Vellananga—; *Tamil*: Vellainangu—.

FLACOURTIA.

This genus numbers 15 species distributed over tropical Asia and Africa.

The following are used medicinally in Indo-China—*F. cataphracta* Roxb.—; in La Reunion—*F. cataphracta* Roxb., *F. Ramontchi* L'Herit.—; in Madagascar—*F. Ramontchi* L'Herit., *F. sepiaria* Roxb.—; in Gold Coast—*F. flavescens* Willd.—.

A. Thorns not bearing flowers and fruit.
  1. Drupe size of a plum, purple when ripe ... ... 1. *F. cataphracta.*
  2. Drupe size of a pea. Stigmas 5-11 ... ... 2. *F. Ramontchi.*

B. Thorns bearing flowers and fruit ... ... 3. *F. sepiaria.*

1. **Flacourtia cataphracta** Roxb. is found in Kumaon, Orissa, Lower Bengal, Assam and Chittagong, whence it spreads to the Malay Peninsula and the Malay Archipelago.

Yunani practitioners often prescribe the bark and leaves, while Ayurveda doctors seem to favour the use of the fruit.

The bark, macerated in cold water, is given in Behar for the relief of hoarseness. A decoction is used in Lakhimpur for the treatment of biliousness; and it is much employed in La Reunion as an astringent and diuretic.

The leaves are said to have diaphoretic properties.

The leaves and young shoots taste like rhubarb, and are supposed to possess astringent and stomachic properties; they are prescribed in diarrhœa, weakness, and consumption.

The fruit is recommended as useful in bilious conditions and, like most acid fruits, it no doubt relieves the nausea and checks the purging.

Arabic: Talisfir, Zarnab—; *Bengal*: Beunch, Paniala—; *Bombay*: Jaggam, Jangama, Tambath—; *Burma*: Naydwed, Naywe—; *Canarese*: Chankali, Goraji, Kirinelli, Talisapatri—; *Dehra Dun*: Jamnua, Pachnala—; *French*: Prunier d'Inde—; *Gujerat*: Talispatra—; *Hindi*: Paniala, Panialah, Paniamalak, Paniaunvola, Talispatri—; *Indo-China*: Bo quan, Mu cuon, Mung quan—; *Kadir*: Saralanka—; *Konkani*: Jagomi—; *La Reunion*: Prune malgache—; *Malayalam*: Kanji, Talisam, Vayukattan—; *Marathi*: Tambat—; *Persian*: Talispatar—; *Portuguese*: Mamonga—; *Sanskrit*: Ahini, Kalameshi, Khadiraparni, Paniyamalaka, Prachinamalaka, Talishapatra, Varibadaram, Vidara—; *Saora*: Kuski, Kusus, Mullumanu—; *Sinhalese*: Ratangwassa, Rata uguressa—; *Tagalog*: Bitanhol—; *Tamil*: Saralu, Talisam, Talisapatri, Vayangarai—; *Telugu*: Kuragayi, Talisapatramu—; *Tulu*: Koraji—; *Uran*: Paniyara—; *Urdu*: Tulispatar—; *Uriya*: Baincha, Panionla—.

2. **Flacourtia Ramontchi** L'Herit. is common throughout India, wild and cultivated. It is found in the indaing and dry forests of Burma.

In Chota Nagpur the bark is applied to the body along with that of *Albizzia odoratissima*, at intervals of a day or so, during intermittent fever.

In La Reunion the bark is used as an astringent and diuretic.

In Madagascar the root is prescribed in nephritic colic; the fruit is considered diuretic.

The fruit is sweet, appetising and digestive. It is given in India for jaundice and enlarged spleen.

The gum is given, along with other ingredients, for cholera,

After child-birth, among natives in the Deccan, the seeds are ground to powder with turmeric, and rubbed all over the mother's body to prevent rheumatic pains from exposure to damp winds.

Akola: Gurgati, Parbekal, Parekal—; *Almora*: Kanel—; *Amraoti*: Kakai—; *Banswara*: Kanker—; *Bengal*: Binja, Kakai, Katai, Obir, Tambat—; *Betsimisaraka*: Valamoly, Voatronaka—; *Betul*: Kakai—; *Bombay*: Bhekal, Kaikun, Kakad, Kantaka, Pahar, Swadu, Tambat—; *Buldana*: Parbekal, Parekal—; *Burma*: Nayuwai—; *Canarese*: Gajabira, Gajale, Hettarimullu, Hunmunki, Muldindu, Mullutari, Nayibela—; *Central Provinces*: Bilati, Kakein, Kank, Kanki, Karumurukki—; *Coorg*: Gapra, Gupra—; *Deccan*: Bowchi, Bunj, Kanbowchi, Kundayi, Swadu—; *Dehra Dun*: Kango—; *English*: Ceylon Plum, Madagascar Plum, Mauritius Plum—; *Gond*: Armasuri, Katien—; *Gujerat*: Kankod—; *Hindi*: Bhanber, Bilangra, Bowchi, Bunj, Handi, Kakai, Kakein, Kandai, Kandei, Kanju, Katahi, Katar, Kukar, Kundayi—; *Khond*: Sapka—; *Kolami*: Mehrle, Mehrlo, Merlee, Sarlarka, Serali—; *Kumaon*: Bilangra, Bilangur—; *Kurku*: Gurgoti—; *Lambadi*: Lotpatar—; *La Reunion*: Prune malgache marronne—; *Madagascar*: Lamoty—; *Marathi*: Bhekal, Kaker, Paker, Tambat—; *Mauritius*: Prune malgache—; *Melghat*: Gurgati—; *Mhairwara*: Kaikun—; *Mundari*: Meriedaru—; *Nimar*: Parbekal, Parekal—; *Palamou*: Katail—; *Punjab*: Kakoa, Kandei, Kangu, Kukai, Kukoa—; *Sanskrit*: Swadukantaka—; *Santal*: Merlec—; *Saora*: Bejjuven—; *Seychelles*: Prunier—; *Sind*: Bavache, Bhutankas—; *Sinhalese*: Ugurassa, Uguressa—; *Tamil*: Maulkkarai, Sottaikala—; *Telugu*: Bontakandregu, Kanaregu, Kandregu, Nakkanaregu, Nakkaneredu, Nelli, Peddakanaregu, Putikatada—; *Uriya*: Balibhaincho, Boniso, Kontadhawra, Kontaikuli, Mamuri, Potnaboniso—; *Yeotmal*: Kakai—; *Zambesi*: Batoko Plum—.

3. **Flacourtia sepiaria** Roxb. occurs in the dry jungles throughout Bengal and the Western Peninsula; in the scrub forests of the Madras Presidency, especially on the Coromandel Coast and in the Deccan; in Bihar, Orissa, Upper Burma, the Andamans; Ceylon and Java.

In Madagascar an infusion of the leaves and roots is given in cases of snake-bite; the bark triturated in oil is used as a liniment in rheumatism; the ashes of the root are considered serviceable in kidney troubles.

Mhaskar and Caius have established experimentally that neither the leaves nor the roots are an antidote to snake venom.

Bombay: Atruna, Tambat—; *Canarese*: Mirde, Miridi—; *Central Provinces*: Bainch—; *Gujerat*: Lodri—; *Hindi*: Kondai, Kondari—; *Malayalam*: Kurumuli—; *Marathi*: Atran, Tambat—; *Porebunder*: Lodri—; *Punjab*: Dajkar, Jidkar, Khatai, Kingro, Sherawane, Zargal—; *Sakalave*: Lamoty—; *Tagalog*: Bitongol—; *Tamil*: Kodumundi, Sottaikala—; *Telugu*: Kanaregu, Kandregu, Pulivelaga—; *Uriya*: Baliboniso, Boniso, Botubo, Kankui, Sanubainchi—; *Visayan*: Sanasaua—.

GYNOCARDIA.

The only species, **Gynocardia odorata** R. Br., is an evergreen tree of moderate size to be found in Sikkim, the Khasia Hills, Chittagong, and the Martaban Hills.

The fruit is used as a fish poison.

The oil from the seeds is used in the treatment of leprosy and other forms of skin diseases.

In Indo-China the seeds are considered tonic, but they are used externally only; they are pounded, mixed with oil, and applied topically in skin diseases.

Bengal: Chaulmugra, Chaulmugri, Petarkura—; *Bombay*: Chaulmogra—; *Chinese*: Ta Foung Leao—; *Hindi*: Chaulmogra, Chhalmugra, Choulmungri—; *Indo-China*: Dai phong tu, Doc chat—; *Lepcha*: Tukkung—; *Magahi*: Tungpung—; *Nepal*: Kadu—; *Persian*: Brinjmogra—; *Sanskrit*: Alasakapaha, Kushthapa, Sagarodbhuta, Tuvaraka—; *Sinhalese*: Taliennoe—.

HYDNOCARPUS.

The genus consists of 25 Indo-Malayan species.

A medicinal oil is extracted from the seeds.

H. anthelmintica Pierre is used in China and Indo-China, *H. polyandra* Blanco in the Philippine Islands.

1. Petiole 6-9 mm. long. Flowers 9-12 mm. in diameter, white	*H. Wightiana.*
2. Petiole 12 mm. long. Flowers 13 mm. in diameter.	*H. venenata.*
3. Petiole 12-15 mm. long. Flowers rose, petals 15 mm. long	*H. anthelmintica.*

1. **Hydnocarpus Wightiana** Blume occurs in the tropical evergreen forests of South-Western India along the Western Ghats, from the Konkan southwards, and below the Ghats in Kanara and Malabar in damp situations; it is common in Travancore, and is found up to an altitude of 3,000 feet.

The seeds have long been employed as a domestic remedy in cases of skin disease and ophthalmia, and as a dressing for wounds and ulcers. Their medicinal properties depend wholly on the oil they contain, which is much more useful and convenient as a drug than the seeds themselves.

The oil is employed as an external application to scabby eruptions, after being mixed with an equal portion of *Jatropha Curcas* oil, sulphur, camphor, and lime-juice. For scald-head equal parts of the oil and lime-water are used as a liniment. In Travancore half teaspoonful doses are given internally in leprous affections, and the oil, beaten up with the kernels and shells of castor-oil seeds, is used as a remedy for itch.

Bicol: Butungmanoc—; *Bombay*: Kadukavatha, Kauti, Kava, Kowti—; *Canarese*: Bhutahi, Garuduphala, Niradivittulu, Surante—; *Deccan*: Janglibadam—; *Goa*: Kosto—; *Kadir*: Koti, Nirvetti, Vattai, Vetti—; *Konkani*: Konstel, Konxtti—; *Malayalam*: Koti, Maravetti, Maroti, Niralam, Nirvetti, Vetti—; *Marathi*: Kadukavata, Kantel, Kastel, Kowti—; *Sanskrit*: Garudaphala—; *Sinhalese*: Makulu—; *Tamil*: Maravattai, Maravetti, Niradimuttu—; *Telugu*: Adavibadamu, Niradi—; *Tulu*: Surante—.

2. **Hydnocarpus venenata** Gaertn. is found in Ceylon by the bank of rivers up to 2,000 feet, also in Malabar, Tinnevelly, and Travancore,

The seeds are employed to poison fish; but the fish thus killed are unfit for food.

The oil is used as an external application in certain cutaneous diseases, and has a special reputation in leprosy.

The oil from the seeds was administered to twenty cases of leprosy and was found very beneficial in early cases and slightly so in long standing cases (Koman).

Deccan: Jinglibadam—; *Hindi*: Janglibadam—; *Malayalam*: Moratti, Niredumuttu—; *Marathi*: Kauti—; *Sinhalese*: Makulu—; *Tamil*: Maravittai, Niradimattu, Niridumuttu—; *Telugu*: Niradi, Niruduvittulu—.

3. **Hydnocarpus anthelmintica** Pierre occurs in Siam and Indo-China up to elevations of 1,000 feet, and is in cultivation at Singapore. It is generally to be found on the banks of rivers and estuaries where the water table is high.

In Cambodia the bark is prescribed for incontinence of urine.

The seed is extensively used in Indo-China for the treatment of cutaneous diseases.

The oil from the seeds has for ages been employed by the Chinese in the treatment of parasitic pediculi, leprosy, and many skin affections.

Annam: Chum-bao lon—; *Cambodia*: Krabao phle thom—; *Chinese*: Feng Yu Tzu, Ta Feng Tzu, Ta Fung Tze—; *Indo-China*: Dai phong tu—; *Malaya*: Foong yau tze—; *Siam*: Lukrabao, Maikrabao—.

PANGIUM.

The sole species, **Pangium edule** Reinwdt., is common in Malaya by river banks and in villages. It is distributed to the Malay Islands.

Every part of the plant is used as an anthelmintic in the Philippine Islands.

The bark is used by the Malays and the Javanese as a poison to fish.

The poisonous properties of the plant are well known to the Malays. The seeds are the most toxic part, but apparently only when they are quite fresh and in the raw state. The fresh seeds are used by the Sakais in making dart poison, and the oil expressed from raw seeds is added to cakes by Malay criminals to cause death.

Oil expressed from sun-dried seeds is often used as an article of food, but is said to cause diarrhœa.

The seeds boiled, cut up and macerated in water are eaten, the oil extracted used in cookery. At Amboina the toxicity is destroyed by crushing the seed and macerating it for some time in pure water.

The toxic properties of the fresh seeds and oil are due to the presence of a poisonous glucoside breaking down and producing prussic acid.

Malay: Kepayang, Kepayung, Payung—; *Tagalog*: Pangi—; *Visayan*; Pangui—.

TARAKTOGENOS.

The genus numbers 12 species spread over Assam, Burma, Indo-China, Malaya, and the Dutch East Indies.

Taraktogenos Kurzii King occurs in Assam, Chittagong, the Minbu district of Upper Burma, the eastern and northern slopes of the Pegu Yoma, Tenasserim, and Martaban, where it is very common.

The seeds yield the Chaulmoogra Oil of commerce and medicine.

Assam: Lemtam—; *Burma*: Kalanzo, Kalaw, Kalawaso, Kalawni, Kalawso—; *Lepcha*: Tukakunga—.

II.

The PITTOSPORACEÆ are trees or shrubs, often climbing. They form 10 genera, which, except for *Pittosporum*, are confined to Australia.

PITTOSPORUM.

This genus numbers 70 species inhabiting the tropical and subtropical regions of the Old World.

The following species are used medicinally in Indo-China—*P. tobira* Ait.—; in the Philippine Islands—*P. brachysepalum* Turcz. —; in La Reunion—*P. senacia* Putterl.—; in South Africa—*P. viridiflorum* Sims.

Pittosporum napaulense Rehder and F. H. Wils. (=*P. floribundum* Wight and Arn.) is found in the subtropical Himalaya, from Sikkim to Garhwal, ascending to 5,000 feet on the hills, and at Mishmi; also in Ganjam, in the Western Peninsula from the Konkan to the Nilghiris, in the hills of South Arcot and Salem.

The bark is bitter and aromatic, and is said by the tribes of the Western Ghats to possess narcotic properties. It is used in doses of 5 to 10 grs. as a febrifuge, and in doses of 50 grs. is believed to be a specific for snake poisoning; 5 to 10 grains doses of the dried bark were given with benefit in chronic bronchitis. It is a good expectorant, but in one or two cases in which it was tried in Bombay, it gave rise to dysenteric diarrhœa.

Among the Mundas of Chota Nagpur the bark is ground with water and rubbed over inflammatory dropsical or rheumatical swellings, and on the limbs in all cases of rheumatism.

Mhaskar and Caius have shown experimentally that the bark is not an antidote to snake venom.

Bombay: Yekadi, Yekdi—; *Canarese*: Tammata—; *Kharwar*: Baghmuta—; *Kisan*: Baghmuta—; *Lepcha*: Bongzam, Prongzam—; *Marathi*: Vehkali, Vehyenti, Vikhari, Yekadi—; *Naguri*: Herekasmar, Umarsing—; *Nepal*: Tibiloti, Tibilti—; *Saora*: Pida, Rakamuki, Rongosani—; *Tamil*: Nanjundai, Tammata—; *Telugu*: Rakamuki—; *Uriya*: Debosundu—; *Visayan*: Balungcanayan—.

III.

The POLYGALACEÆ are herbs or undershrubs, rarely small trees, distributed over the tropical and warm southern temperate zones. They include 10 genera with about 700 species.

All the members are more or less tonic, and expectorant; some are bitter, and emetic; a few are acrid, and poisonous. The bark of genus *Krameria* is very astringent.

Saponins—senegin, polygalic acid—and *methyl salicylate* are amongst the few compounds isolated; also *glucosides*—gaultherin, polygalin—.

The medicinal and poisonous Milkworts of the world belong to 8 genera: BADIERA (West Indies), BREDEMEYERA (Australia, Tasmania, South America, West Indies); CARPOLOBIA (tropical West Africa); KRAMERIA (Mexico to Chili); MONNINA (Mexico to Chili); MUNDTIA (South Africa); POLYGALA (cosmopolitan; except New Zealand, Polynesia, and Arctic zone); SECURIDACA (tropics; except Australia).

All Milkworts used medicinally in India belong to the genus POLYGALA.

POLYGALA.

The genus numbers 475 species distributed over the whole world, except Tasmania.

The following species are used medicinally in Europe—*P. amara* Linn., *P. calcarea* F. W. Schultz., *P. major* Jacq., *P. monspeliaca* Linn., *P. nicaeenis* Risso, *P. rupestris* Pourr., *P. serpyllacea* Weihe, *P. vulgaris* Linn.—; in Japan and China—*P. sibirica* Linn.—; in Indo-China—*P. glomerata* Lour., *P. sibirica* Linn.—; in Malaya—*P. Reinii* Franch. & Sav., *P. sibirica* Linn.—; in North America—*P. boykini* Nutt., *P. polygama* Walt., *P. sanguinea* Linn., *P. Senega* Linn.—; in Mexico—*P. scoparia* H. B. & Kunt—; in Brazil—*P. angulata* DC., *P. fimbriata* A. W. Ben., *P. paniculata* Linn.—; in Guiana—*P. timoutou* Aubl.—; in West Africa —*P. arenaria* Willd., *P. butyracea* Heck., *P. guineensis* Willd., *P. micrantha* Guill & Perr.—; in Southern Africa—*P. amatymbica* E. & Z., *P. arenaria* Willd., *P. hottentota* Presl., *P. myrtifolia* Linn., *P. oppositifolia* Linn., *P. serpentaria* E. & Z., *P. tenuifolia* Link.—; in Madagascar—*P. macroptera* DC.—.

P. amara and *P. Senega* contain a toxic glucoside, polygalin.

Undershrubs, or herbs sometimes woody at the base. Calyx persistent. Keel crested.
A. Bracts persistent, at least till the flower expands.
    1. Undershrubs. Racemes axillary; wings petaloid, membranous; strophiole 2-appendiculate ... *P. crotalarioides.*
    2. Herbs. Wings herbaceous, strophiole 3-appendiculate.
        a. Flowers minute, 1/10 in. long, yellow. Racemes longer than the leaves ... ... *P. brachystachya.*
        b. Flowers 1/6 in. long. Racemes longer than the leaves ... ... *P. elongata.*
        c. Flowers 1/5-¼ in. long. Racemes much shorter than the leaves ... ... *P. chinensis.*

B. Bracts caducous (before flowering), strophiole 3-appendiculate.
  1. Capsule rather broadly winged, glabrous, not ciliate ... ... *P. sibirica.*
  2. Capsule glabrous, margined, not ciliate ... *P. telephioides.*
  3. Capsule narrowly winged, strongly ciliate ... *P. glomerata.*

1. **Polygala brachystachya** Bl. occurs in Malaya and is found in turf, roadsides, and grass plots.

The Malays use the plant as an antidote in cases of snake-bite.

2. **Polygala chinensis** Linn. is found throughout India, from the Punjab to Burma, South India, and Ceylon, up to 5,000 feet. It extends to tropical Asia and Australia.

In Chota Nagpur the root is given medicinally in cases of fever and dizziness.

English : Common Indian Milkwort—; *Gujerat* : Pilibhonyasana—; *Hasara* : Birminditasad—; *Hindi* : Meradu, Miragu—; *Marathi* : Negli—; *Nagpuri* : Danaminjo, Danaminju, Gurgur—; *Porebunder* : Pilibhoysana—; *Santali* : Gaighura—.

3. **Polygala crotalarioides** Ham. is found on the temperate Himalaya from Simla and Chamba to Sikkim, between 4,000 and 7,000 feet, also on the Khasia Hills.

The entire plant and root have a reputation as remedies for cough and pulmonary catarrh.

Among the Mundas of Chota Nagpur the root is chewed, or else ground and drunk with water, to expel phlegm from the throat; it provokes coughing.

Royle states that the plant was sent to him with the information that the root was employed as a cure for snake-bite by the hill people of the Himalaya.

The plant is not an antidote to snake venom (Mhaskar and Caius).

Gond : Bijnori—; *Hasada* : Birheremda—; *Mundari* : Heremola—; *Nagpuri* : Lilkanth, Nilkanth—; *Santali* : Gaighura, Lilkanthi, Lilkathi—.

4. **Polygala elongata** Klein occurs in the Western Peninsula from the Konkan southwards, and extends to Ceylon.

The plant is used in biliousness and constipation. It is said to be antidote to snake poison.

Malayalam : Periyananka—.

5. **Polygala glomerata** Lour. is found in Sikkim, Assam, the Khasia Hills, and Burma, whence it extends to the Malay Archipelago and China.

In Indo-China a decoction of the stems and leaves is given in inflammatory conditions.

Indo-China : Kim bat hoan—.

6. **Polygala sibirica** Linn. occurs in temperate and subtropical Himalaya at 1,000-6,000 feet; in Sikkim at 8,000 feet; from the Punjab and North-Western Frontier to Bhotan; on the Khasia

Hills at 4,000-6,000 feet; in the Western Ghats from the Nilgiris to Tinnevelly, chiefly above 6,000 feet; in Ceylon. It is distributed to China, Japan, and Siberia.

In Japan, China, and Malaya the roots are given as a substitute for senega in colds and coughs.

In Indo-China they are used as a diuretic; they are also given in bronchitis, amnesia, sexual impotency, and seminal losses.

Brahui: Kaj, Mashnakaj—; *Cantonese*: Ven Chi—; *Chinese*: Yuan Chih—; *English*: Japanese Senega—; *German*: Schlangenwurzel—; *Indo-China*: Nam vien chi, Re tieu thao, Vien chi—; *Japanese*: Hime hagi—; *Malaya*: Yoan chee—.

7. **Polygala telephioides** Willd. occurs in the Carnatic, Nellore, Chingleput, Travancore, Ceylon. It spreads to the Malay Archipelago and China.

The plant and the root are used medicinally in catarrhal affections.

IV.

The FRANKENIACEÆ are herbs or shrublets, which inhabit tropical and temperate maritime shores, and principally the Mediterranean and Atlantic, extending into central Asia and north-western India; they are comparatively rare in the tropics and southern latitudes. They form a small family of 4 genera with 60 species.

FRANKENIA.

This genus consists of 32 species, mostly sea-side plants inhabiting the temperate and subtropical regions of both hemispheres.

F. grandifolia Cham. and Schlecht. is used medicinally in California.

Frankenia pulverulenta Linn. occurs in Sind, Baluchistan, and Punjab. It is a wide-spread species on shores and in salt deserts, distributed over the Mediterranean regions, Arabia, Senegal, and the Cape.

Valued by native practitioners in the fresh state for its mucilaginous and aromatic properties; exhibited in the form of decoction in empyreuma (Murray).

Arabic: Garmal—; *Egypt*: Ghobeyra, Gurmeyl, Homra, Kheyet, Mulleygh—; *English*: Powdery Sea-Heath—; *Malta*: Mealy Sea-heath—; *Sind*: Khareeya—.

V.

The PORTULACACEÆ are herbs, rarely undershrubs, usually glabrous and more or less succulent. The family includes 17 genera with 225 species, mostly natives of America and South Africa.

The medicinal Purslanes of the world belong to 3 genera: ANACAMPSEROS (South Africa); PORTULACA (tropical and subtropical regions); TALINUM (Africa, America, India).

The Purslanes used medicinally in India all belong to the same genus, PORTULACA.

PORTULACA.

The genus numbers 20 species distributed over the tropical and subtropical regions of the world.

Fleshy, insipid plants. They are considered cooling, diuretic, and recommended in scurvy and urinary affections.

The following are used medicinally in Europe—*P. oleracea* Linn.—; in China and Indo-China—*P. oleracea* Linn., *P. sativa* DC.—; in the Philippine Islands—*P. oleracea* Linn., *P. quadrifida* Linn.—; in the United States—*P. oleracea* Linn.—; in Brazil—*P. patens* Linn., *P. pilosa* Linn.—; in Guinea—*P. oleracea* Linn.—; in Gold Coast—*P. oleracea* Linn., *P. quadrifida* Linn.—; in Southern Africa and Portuguese East Africa—*P. quadrifida* Linn.—; in La Reunion and Madagascar—*P. oleracea* Linn.—.

A. Nodes without appendages. Flowers in clusters ... *P. oleracea.*
B. Nodes with a ring of hairs.
  1. Leaves opposite ... ... *P. quadrifida.*
  2. Leaves alternate, root tuberous ... ... *P. tuberosa.*

1. **Portulaca oleracea** Linn. occurs in all warm countries. It is found all over India, up to 5,000 feet in the Himalaya.

The plant has long been used as a domestic remedy in all the various countries where it is found growing. It is reputed vulnerary, antiscorbutic, refrigerant, and mildly diuretic; and it is said to be useful in catarrhal affections of the genito-urinary tract. Thus Culpeper: 'It is good to allay the heat of the liver, blood, veins, stomach, and hot agues: it stays hot and choleric fluxes of the belly, women's courses, the whites, and gonorrhœa, the distillation from the head, and pains therein proceeding from heat, want of sleep, or the frenzy.'

At the present day, the herb is chiefly valued as a refrigerant and alterative pot-herb, particularly useful as an article of diet in scurvy and liver disease.

In Colombia the plant is used as an emollient, and is applied to tumours and callosities. Similarly, in West Tropical Africa it is used for local application to swellings, bruises, whitlow, etc., crushed along with native natron and oil and applied by rubbing or as a poultice for abscesses and boils to bring them to a head.

In Siberia the herb is used as a gastric sedative; it is also given as a vegetable to a baby who has ceased to thrive; along with an aromatic Labiate plant it is a remedy for haematuria and other urinary troubles.

In Jamaica the herb is employed as a cooling and moistening remedy in burning fevers.

The herb, bruised, and applied to the forehead and temple, is said to allay excessive heat and pain, and applied to the eyes to remove inflammation. Quoth Culpeper: 'The herb if placed under the tongue assuayeth thirst. Applied to the gout, it easeth pains thereof, and helps the hardness of the sinews, if it come not of the cramp, or a cold cause.'

The expressed juice of the plant may be applied with advantage to prickly heat, as well as to the hands and feet when a burning sensation is felt. It is said to afford relief in cases of scorpion sting.

In Jamaica, the juice is of use in spitting of blood. In West Tropical Africa it is sometimes dropped in the ear for earache, and is used for toothache. With oil of roses, it was recommended in England for sore mouths and swollen gums, and also to fasten loose teeth.

The expressed juice of the herb is an ingredient in a Hausa prescription for syphilis.

In China the leaves are used for poulticing tumours, bad wounds and ulcers, œdematous swellings; also in blennorrhagia and leucorrhœa. In Nigeria they are applied topically to swellings.

In Indo-China a decoction of the leaves is given in dysentery.

In Gold Coast the leaves are ground, mixed with oil, and tied on boils to bring them to a head; they are eaten along with tiger nuts—*Cyperus esculentus*—as a remedy for skin diseases; also macerated in cold water and taken frequently they are considered to be a heart tonic and diuretic, used for palpitations.

In Indo-China the juice of the fresh leaves is applied to abscesses, and used as a collyrium. In North America it is considered a cooling diuretic.

In the Tamil country a thick paste obtained by mixing together the juice of the leaves, human milk, and sesamum oil is rubbed over the abdomen to help the expulsion of the retained placenta in cases of uterine inertia.

The bruised fresh leaves are prescribed by the Tamil practitioners as an external application in erysipelas; an infusion of them is also ordered as a diuretic in dysuria.

The seeds have always been credited with anthelmintic properties, and they are still given as a vermifuge in the Punjab. In England they were bruised and boiled in wine when used as a worm remedy for children.

In Cochin-China and in the West Indies the seed is frequently used as a stomachic and as a provocative of the menses, as well as an emollient and diuretic.

Caius and Mhaskar have shown experimentally that the plant is not an antidote to scorpion venom.

Afrikaans: Misbredic, Porselein, Postelein, Varkkos—; *Akim*: Adwera—; *Annam*: Rau sam, Rau tham—; *Arabic*: Baglah, Baglatulhumga, Bogl, Buklut-ul-hakima, Buklut-ul-kukema, Dhoneb el farras, Khurfa, Kurfakara, Rigl—; *Ashanti*: Adwera, Adwere, Asase-ne-aboo—; *Australia*: Pigweed—; *Baluchi*: Pechali, Pichali—; *Bambara*: Missidi kumbaré—; *Bengal*: Baraloniya, Chhotalunia, Kulfi, Munya—; *Betsileo*: Kalabotetraka—; *Bicol*: Ausiman—; *Bombay*: Gol, Kurfah, Motighol—; *Brahui*: Mugher, Pechali, Pichali—; *Burma*: Mayabyit—; *Canarese*: Dudagorai—; *Central Provinces*: Ghol, Gholu—; *Ceylon*: Nilappachali, Pulichankirai—; *Chinese*: Ma Ch'ih Hsien, Ma Tche

Han—; *Colombia*: Verdolaga—; *Dagomba*: Zinerigu—; *Danish*: Portulak—; *Deccan*: Mulfekibhaji—; *Dutch*: Porselein—; *Efik*: Efere makara—; *Egypt*: Bakle, Higl, Rigl—; *English*: Common Purslane, Garden Purslane, Golden Purslane, Pigweed, Purslane—; *Ewe*: Aflaa, Aflangtokpui, Devio-fe'ama, Dugba, Kugbe—; *French*: Porcelin, Porcellane, Pourcellaine, Pourcellane, Pourpier, Pourpier commun, Pourpier cultivé—; *Fulani*: Bechalhi, Endu nagge—; *Ga*: Awrorke—; *German*: Portulak—; *Greek*: Andrachni, Andrakla, Andraklida, Antrakla, Glistrida—; *Gujerat*: Loni, Motiluni—; *Hausa*: Babba jibji, Da'burin saniya, Fasa k'aba, Fasa kumburi, Halshen rago, Halshen saniya, Halshen tunkiya, Rub da tukubya, Sarkin jibji—; *Hindi*: Baralaniya, Baralunia, Chhotalunia, Khurfa, Khursa, Kulfa, Kulfi, Kurfa, Kurfekasag, Lonia, Lunak, Lunia, Luniakulfah, Lunuk, Muncha, Munya, Nonkha, Nonkhalunuk, Sagkulpha—; *Hova*: Tsikobokobondanitra—; *Indo-China*: Ma si hien, Ma xi hieu, Rau sam—; *Iraq*: Barbin, Hamga—; *Italian*: Porcellana, Portulaca—; *Japan*: Osuberi-hiyu—; *Jhalawan*: Pichli, Shurdako—; *Kachhi*: Lunak, Pichlo—; *Kalmuk*: Assun obison—; *Katsina*: Fasa k'aba—; *Kohlu*: Lunak—; *Kolami*: Dali ara—; *Konkani*: Gol, Golchibagi—; *Krepi*: Aflaakupe, Aflaatokplei, Aflangtokpui—; *Krobo*: Nereyu, Nerufu—; *Kumaon*: Lunak, Luniyahkulfah—; *Kurdish*: Parpinah—; *Languedoc*: Poutoulaigo—; *La Reunion*: Pourpier, Pourpier rouge—; *Las Bela*: Manshuri—; *Malay*: Segan—; *Malayalam*: Koricchira—; *Malinke*: Mazabi—; *Malta*: Purslane, Porcellana, Sportellacchia, Burdliecka—; *Mano*: Toa p'lo—; *Marathi*: Bhuigholi, Ghole, Motighol—; *Mauritius*: Pourpier rouge—; *Mende*: Toge, Tondo wolii, Tooge—; *Mundari*: Dailara, Urialangara—; *Nasirabad*: Lunak—; *North America*: Common Purslane, Parsley, Pussly—; *North Queensland*: Thukouro—; *North-Western Provinces*: Desikulfah, Lunak, Luniya, Muniya—; *Nubia*: Segettemam—; *Persian*: Cholza, Kherefeh, Khurfah, Kurfah, Tirehkhurfeh, Turk, Turuk—; *Polish*: Kurza nega—; *Porebunder*: Mhotiluni—; *Portuguese*: Beldroega—; *Punjabi*: Sagkulfa—; *Pushtu*: Murlai, Tursbuk, Warkharai—; *Roumanian*: Iarba grass, Portulaca—; *Russian*: Portulak, Schrucha—; *Sadam*: Dailsag—; *Sakalave*: Fandrianomby—; *Sanskrit*: Brihalloni, Gholika, Lona, Loni, Lonika, Lunia—; *Santal*: Mota uric'alang—; *Shahrig*; Lunak—; *Sinaloa*: Verdolaga—; *Sind*: Lonk—; *Sinhalese*: Gendakola—; *Songhai*: San mafé—; *Spanish*: Verdolaga—; *Suto*: Selele—; *Swedish*: Portulak—; *Tagalog*: Colasiman, Golasiman, Olasiman, Sayican—; *Tamil*: Karikkirai, Kolhikirai, Paruppukkirai, Passalakkirai, Pulikkirai—; *Telugu*: Boddipavilikura, Gangapavilikura, Pappukura, Peddapavilikura—; *Toba*: Khulfa, Mirri—; *Tuareg*: Alokha, Alora, Aloza, Bender akech—; *Twi*: Adwera, Adwerair—; *Urdu*: Khurfah—; *Uriya*: Purunisag—; *Wolof*: Tang i mpiteurh, Tanguipeter—; *Yemen*: Brabra, Chamile, Denneb el farras, Rijlet el farras—; *Yoruba*: Papasan—.

2. **Portulaca quadrifida** Linn. is found throughout the warmer parts of India and Ceylon. It spreads to tropical Asia and Africa.

The plant is used as a substitute for *P. oleracea*.

The infusion is in Pondicherry a household remedy for cystitis in the last months of pregnancy. The Zulus use it as an emetic.

The natives of Portuguese East Africa take a decoction of the plant as an anthelminitic, and in the treatment of stomach complaints and gonorrhœa.

The plant is sometimes used as a pot-herb in Guam, either for food or as an antiscorbutic. In Gold Coast and in Lagos it is used to cure toothache.

The Arabs apply the bruised fresh leaves to the forehead in cephalalgia.

Arabic: Baglat-ul-arabbiyah, Baglat-ul-yamaniyah, Budelut-ul-mubarik, Kora-at errai, Rozzi, Sebib ed-dhan—; *Ashanti*: Asase-ne-aboo—; *Bengal*: Chhotaluniya, Muniya—; *Bettani*: Perkhadai—; *Bombay*: Barikaghola, Chavalkebhaji, Chowli, Gholkibhaji, Kota—; *Canarese*: Halibochcheli—; *Ceylon*: Chirupachalikkirai, Parupukirai—; *Deccan*: Chaunlayikibhaji, Chowli, Gholkibhaji—; *Ewe*: Dugba, Kugbe—; *Gold Coast*: Stone Crop—; *Gujerat*: Jhiniluni, Luni—;

Hindi: Baklatalhamka, Chaunlayi, Chotaluniya, Khatechawal, Loniya—; *Kolami*: Suniara—; *La Reunion*: Pourpier marron—; *Malinke*: Mazabi—; *Marathi*: Katechanval, Kathechawal, Ranghol—; *Porebunder*: Badhi, Jinkiluni—; *Portuguese East Africa*: Sanimarumbi—; *Pondicherry*: Baselle, Pourpier grimpant—; *Punjab*: Haksha, Lunak, Lunkibuti—; *Rajputana*: Lunki—; *Samoa*: Fiafiatuli—; *Sanskrit*: Kshudragholika, Laghughonika, Laghulonika, Upadyaki—; *Sinhalese*: Hingendakola—; *Spanish*: Yerba de pollo—; *Tagalog*: Sayican—; *Tamil*: Passalaikkirai, Passelikkirai, Sinnaparpukkirai, Siruppassaraikkirai—; *Telugu*: Batsalikura, Goddupavili, Kura, Pavili, Payalaku, Peddapavili, Saunapappu, Saunapavili, Sunapailkura—; *Waziri*: Zhinai—; *Yemen*: Mortah—.

3. **Portulaca tuberosa** Roxb. is found in Bihar, Sind, Gujarat, the dry districts of the Carnatic from South Arcot to Travancore, whence to Ceylon.

The fresh acid leaves are used medicinally; an external application is prescribed by native practitioners in erysipelas and an infusion in dysuria (Murray).

Marathi: Jangligajar—; *Sinhalese*: Urugenda—; *Sind*: Lunuk—; *Telugu*: Boddakura—.

VI.

The Tamaricaceæ are mostly bushes or small trees, inhabiting the shores, steppes, and deserts of temperate and subtropical regions. They prefer sea-shores, the margins of brackish lakes, the banks of rivers and torrents, in sandy or clayey soils. There are 5 genera with about 100 species.

Medicinal properties are exhibited by members of 3 genera: Myricaria (northern temperate regions); Reaumuria (eastern Mediterranean, Central Asia); Tamarix (Europe, Mediterranean, Asia).

1. Seeds hairy all over, albuminous. Flowers solitary ... Reaumuria.
2. Seeds hairy at the apex, exalbuminous. Flowers racemed or spiked.
    a. Stamens free, styles 3 ... ... Tamarix.
    b. Stamens connate, stigma sessile ... ... Myricaria.

Myricaria.

The genus consists of 10 species distributed over the northern temperate regions of the Old World.

1. Bracts ovate, about twice as long as the pedicels ... *M. elegans.*
2. Bracts ovate-lanceolate, 3-4 times as long as the pedicels ... ... *M. germanica.*

1. **Myricaria elegans** Royle occurs in the Western Himalaya, Kunawar, Spiti, Lahul, Ladakh, Kumaon, up to 14,000 feet.

In Lahul the leaves are used as an application to bruises.

Garhwal: Wombu—; *Punjab*: Humbu, Umbu—.

2. **Myricaria germanica** Desv. is found in temperate and alpine Himalaya, from Sikkim to Kumaon, at altitudes of 10,000-14,000 feet. It spreads to Afghanistan, and westwards to Europe.

A decoction of the bark is used in Spain as an aperient, and in jaundice.

French: Petit tamarisc, Tamarisc d'Allemagne—.

Reaumuria.

The genus numbers 15 species spreading from the Levant to Central Asia.

Reaumuria hypericoides Willd. is indigenous in Sind, Arabia, Syria, the Mediterranean coast, the Salt plains, and in the milder parts of Northern Asia.

It is used in Sind in the cure of porrigo and itch, the bruised leaves being applied externally, and a decoction of two-and-a-half to three ounces of the juice of the leaves diluted and administered internally.

Sind: Laneesah—.

Tamarix.

The genus numbers 65 species, natives of Europe, the Mediterranean, and Asia.

The bark and the galls are astringent; the manna is detergent and aperient; the twigs and the leaves are vulnerary, carminative, and diuretic.

The following are used medicinally in Europe and North Africa—*T. gallica* Linn., *T. africana* Poir.—; in Arabia and Persia—*T. aphylla* Krst.—; in China—*T. chinensis* Lour.—; in Indo-China—*T. chinensis* Lour., *T. pallasii* Desv.—; in Malaya—*T. chinensis* Lour.—.

Stamens 5.

1. Flowers bisexual, in racemose panicles ... ... *T. Troupii.*
2. Flowers unisexual, in close cylindrical spikes ... *T. dioica.*
3. Flowers bisexual, in usually interrupted spikes ... *T. aphylla.*

1. **Tamarix aphylla** Lanza occurs in the Punjab plains, Sind, Cutch, and Baluchistan. It is distributed to Persia, Mesopotamia, Arabia, the Mediterranean, and South Africa.

The galls are employed as an astringent.

The bark is bitter, astringent; powdered, and in combination with oil and *Kamala*, it is used as an aphrodisiac. It is also employed as an application in eczema capitis, and other diseases.

Afrikaans: Abiekwas-gelhout, Dawee—; *Arabic*: Asl-ul-armar, Atl, Ethel, Oethel, Tarfa, Tarf-al-ahmar—; *Bengal*: Raktajhav—; *Deccan*: Laljhav—; *English*: Giant Tamarisk—; *Gujerat*: Laljhav—; *Helmand*: Kohragaz—; *Hindi*: Laljhav—; *Iraq*: Athl—; *Kharan*: Siahgazz—; *Las Bela*: Kirri—; *Northern Baluchistan*: Kirri—; *Pahrod*: Gagaz, Shakargaz—; *Persian*: Farash, Gazesurkh, Khoragaz—; *Punjab*: Faraz, Farash, Farwa, Ghwa, Ghuz, Khagal, Kharlei, Narlei, Pharwan, Rukh, Ukhan—; *Pushtu*: Ghwa, Ghwaz—; *Sind*: Asrelei, Asri, Gaz, Gazlau—; *Southern Africa*: Tamarisk—; *Tamil*: Sivappattushavukku, Sivappukkottashavukku, Sivappusirushavukku—; *Telugu*: Ettashirisaru, Ettaverusaru—; *Tigre*: Obel, Owell—; *Tigrinia*: Obel, Owell—; *Tuareg*: Tabrakat—; *Waziristan*: Khugal—.

2. **Tamarix dioica** Roxb. is a gregarious shrub, found near rivers and on the sea-coast; throughout India from Sind to Burma. It is common along the Ganges, Hooghly, and forms extensive forests along the Indus in Sind. Also common in sandy river-beds and on the sea-coast of the Madras Presidency. It extends to Afghanistan.

The twigs and galls are used medicinally as an astringent.

Baluchi: Podhayaz—; *Bengal*: Jhao, Laljham—; *Betul*: Saran—; *Burma*: Byaungchedauk—; *Hindi*: Jau, Jhau, Lalijhau, Thar-thari—; *Kumaon*: Jhau—; *Ladak*: Reglta—; *Merwara*: Jhau, Kachlei, Pilchi—; *Oudh*: Jhau—; *Persian*: Ghuz—; *Punjab*: Faras, Farwan, Ghasīei, Harwan, Jhau, Kachlei Koan, Lai, Leh, Lei, Panj, Panjpilchi, Pilchi, Rukh—; *Pushtu*: Khwa—; *Sanskrit*: Pisūla—; *Sind*: Gas, Jao, Lao, Lyi, Turunjabin—; *Tamil*: Attumari, Nirumari—; *Telugu*: Palivela, Palligi—.

3. **Tamarix Troupii** Hole occurs in the Punjab, the United Provinces, Sind, Baluchistan, and Mount Abu.

The galls are employed medicinally as an astringent, and administered internally in dysentery and diarrhœa.

The manna is considered to be detergent, aperient, and expectorant.

In Jaisalmer a sherbet made from the fruit is said to be very beneficial in cases of fever brought on from exposure to the hot wind. The shade of the tree is considered injurious to health; a heated traveller resting beneath its shadow is certain to suffer afterwards from fever or rheumatism.

Arabic: Asl, Taffa, Turfah—; *Baluchistan*: Gazkhera, Gazsurkh, Ghazlei—; *Bengal*: Jhau, Jhav—; *Catalan*: Tamarit, Tamariu—; *Central Provnces*: Jhau—; *Ceylon*: Kiri—; *Deccan*: Jhav—; *English*: Tamarisk—; *Gujerat*: Jhavnujhada—; *Hindi*: Jhau, Jhav—; *Italian*: Cipressina, Scopa marina—; *Konkani*: Jahu—; *Malayalam*: Jhavukam—; *Persian*: Gaz, Gazshakar, Shorgaz—; *Punjab*: Jhau, Koa, Lai, Lainya, Pilchi, Rukh—; *Pushtu*: Gazsurkh, Ghaz, Suragaz—; *Rajputana*: Imli—; *Sanskrit*: Aphala, Bahugranthika, Jhavu, Jhavuka, Pichula, Shavaka—; *Sind*: Jhaw, Lai, Lei—; *Spanish*: Taray—; *Tamil*: Attalari, Attuchavakku, Kodaichavukku, Sirusavukku, Sivappattuchavukku, Sivappukkodaichavukku, Sivappusirusavukku, Vannikkay—; *Telugu*: Erusaru, Etttasirusaru, Ettayerusaru, Pakke, Pakkepakki, Palligi, Prakke, Sirasaru—; *Tibet*: Regeeta, Telta—; *Urdu*: Jaheva—.

THE NILGIRI GAME ASSOCIATION—1879-1939.

BY

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(*With 3 plates*).

The year 1939 marks the 60th anniversary of the Nilgiri Game Association and affords a suitable opportunity to review the work it has carried out during that period.

FOUNDATION.

The Association was founded in 1879 by Act of the Madras Government, its declared object being 'the preservation of existing game in the Nilgiri district and the adjoining areas included under Madras Act II of 1879 and the introduction and preservation of other game birds and animals'. That object remains the same today though the fact is perhaps not always fully realised.

The area under its control comprises not only the plateau and low country of the Nilgiris but also parts of the adjacent districts of Coimbatore and Malabar. Within those limits a game licence is necessary for anyone desiring to shoot in reserved forests or on Government lands. These licences are issued by the District Forest Officer and the fees credited to the Association.

ORGANIZATION.

All holders of a season shooting or fishing licence are members of the Association and at an Annual General Meeting they elect a Committee in which vests the management of the affairs and the control of the funds of the Association; about one-third of the shooting members are Indian. The Collector of the Nilgiris for the time being is ex-officio President of the Association and Chairman of the Committee.

According to the Rules the Committee shall elect its own Honorary Secretary but in practice this office for many years has been held by the District Forest Officer for the sake of convenience.

The Collector has under the Act power to close the whole or any part of the area for the whole or any part of the year, to refuse to issue licences in certain cases, and to alter the conditions of the licence. In practice the Collector acts on the recommendations of the Committee, his notifications being published in the District Gazette and entered in the licence.

Infringements of the shooting rules are dealt with by the District Forest Officer as Forest offences, or if sufficiently serious by a First Class Magistrate. All fines recovered are however credited to Government and not to the Association. An important section of the Act forbids the sale of game anywhere in the District during the close season however it may have been obtained.

LICENCES.

Game licences as at present issued consist of a season licence costing Rs. 50 and entitling the holder to shoot 2 Sambur, 2 Chital, 1 Black Buck, 4 Jungle Sheep, 1 Nilgiri Ibex, 1 four-horned Antelope and 1 Bison; while a monthly licence costing Rs. 30 offers a slightly smaller bag. Both these licences, which run from 1st September to 31st August following, cover small game also. For the benefit of short-time visitors there is a weekly big game licence costing Rs. 20 and a weekly small game licence costing Rs. 10. A deposit of Rs. 10 is requried on all licences which is refunded when the return of game shot is sent in. Free licences are issued to the District Forest Officer of the Nilgiris (the Honorary Secretary) and to his Range Officers.

Visitors at present pay the same fees as residents.

In 1933 at the request of the Officer Commanding, Wellington special licences were issued to British soldiers with a fee of Rs. 10 for shooting pig and hare. Six licences only were taken out but the experiment was found undesirable and Government was recommended not to repeat it.

The general conditions of the shooting licence forbid the shooting of females, stags without horns or in velvet, and immature males, the definition of maturity being as follows :—

Sambur and Chital: Horns not less than 28″.
Bison: Horns with a spread of 33″ or a girth of 18″.
Black Buck: Horns not less than 14″.
Ibex: Saddle must be well defined.

The close season for big game runs from 1st July to 31st October. Tigers, Panthers, Bears, Hyenas, Wild Dogs and Pigs are not classified as game and may be shot at any time, but a licence is necessary for their pursuit except on private land.

Shooting *of any kind* from motor vehicles is strictly prohibited as also is shooting of *game* for elephants.

No shooting of any *game* animal is permitted at a waterhole or salt-lick, for a machan or shelter, or by the aid of artificial light.

All wounded animals count to the bag and a minimum bore is prescribed for shooting bison.

Nilgai, Malabar Squirrels and all kinds of monkeys are protected absolutely.

An area in the Kundahs is closed to all beating except for tigers and panthers and a small sanctuary in which no shooting is allowed has been formed near Kargude in the low country.

Small game shooting on the plateau is limited to two days a week. The following table compiled from the annual reports as far back as these are available shows the number of head of big game killed each year since 1912 and the number of licences issued.

Year	Bison	Sambur	Chital	Ibex	Black Buck	Tiger	Panther	Bear	Jungle Sheep	Four horned Antelope	Hyena	Licences		
												Season	Monthly	Weekly
1912–13	1	43	19	9	9	7	17	6	25	1	...	73	20	...
1913–14	...	50	35	6	14	11	31	13	34	1	...	80	34	...
1914–15	...	27	25	2	11	4	16	1	18	...	1	49	17	...
1915–16	5	38	32	3	11	2	12	3	40	2	...	47	34	...
1916-17	2	46	21	3	8	8	25	4	46	...	...	51	19	...
1917–18	4	48	18	1	10	11	29	5	24	1	...	72	32	...
1918–19	2	43	28	3	11	6	20	6	10	...	...	58	50	...
1919-20	7	42	32	3	9	9	40	6	36	...	1	77	41	...
1920–21	10	38	43	1	14	16	26	6	42	1	2	85	38	...
1921–22	9	43	44	1	4	8	32	9	61	1	...	101	45	...
1922–23	12	30	24	2	...	14	47	11	69	...	...	84	42	...
1923–24	6	24	22	1	...	17	35	7	62	...	3	91	27	...
1924–25	2	20	17	1	...	19	27	3	57	...	...	85	22	...
1925–26	4	17	14	2	...	6	10	3	22	2	2	69	22	...
1926–27	2	25	33	5	4	9	6	2	34	...	1	100	26	...
1927–28	4	17	27	9	5	9	21	2	37	1	1	86	33	...
1928–29	6	15	33	9	6	7	13	8	45	...	...	96	25	...
1929–30	2	13	15	8	2	12	7	...	31	4	...	90	19	...
1930–31	14	18	20	5	2	5	1	3	42	...	...	93	25	...
1931–32	6	12	23	11	4	7	5	2	34	...	...	68	30	...
1932–33	6	10	17	10	...	6	8	2	26	...	1	66	18	...
1933–34	5	10	19	4	3	13	8	2	51	...	...	73	17	7
1934–35	5	9	18	2	...	9	11	4	35	...	...	64	28	12
1935–36	13	20	38	9	3	7	11	1	46	...	1	83	20	14
1936–37	6	12	17	5	1	8	6	2	41	2	1	70	15	14
1937–38	14	13	36	10	...	5	12	...	33	2	...	72	23	19

PRESERVATION.

Bison used to be fairly common at one time on the plateau but seldom visit it now, though the tracks of a fine solitary bull were seen at Bangi Tappal some ten years ago. But for all practical purposes they are now confined to the low country on the North and West where they are definitely on the increase, a herd of over 40 having been seen on several occasions this year at Mudumalai.

Heads with a spread of 40″ or over are seldom obtained but there are definite records of 4:—

40½″ in 1898.
41½″ in 1911.
42″ in 1923.
40″ in 1924.

Nothing over 38″ appear to have been bagged in recent years. The numbers shot have increased since a girth of 18″ was included in the definition of maturity some ten years ago.

There was a serious outbreak of rinderpest in the Mudumalai Forest in 1909 affecting both bison and sambur, and the numbers of the former were so depleted that their shooting was prohibited in 1912 for five years. By 1917 they had increased to a satisfactory extent and shooting was reopened in that area. In 1929 there was again a small outbreak of disease in the same forest but only a few animals died, and since then with the exception of a single unconfirmed case of foot and mouth disease the herds have remained healthy.

A number are killed annually by tigers and recently several full grown cows and a fine mature bull (the head of which now adorns the Forest Rest House at Anaikatti) have fallen victims. As usual the hock is the first point of attack in the case of mature animals.

Sambur. Though a fair number are to be found in the low country the great majority are on the plateau where they have so increased in spite of the ravages of tigers, panthers and wild dogs that it has become necessary to have a number of hinds shot annually. The hope was entertained that only barren hinds would be shot and so the breed improved but in practice it has proved quite impossible to distinguish them. The present low horn limit of 28″ was fixed in 1932 in order to allow the shooting of old stags whose horns are going back and whose retention is undesirable, but a glance at the table shows how few mature animals are shot annually, though it must be remembered that the present bag limit is two as against three previously.

The record head for the Nilgiris is said to measure 45″ but this must have been obtained before the Association was formed, as a 42″ bagged in 1905 is stated in the Annual Report to be the largest shot for 40 years. Other fine heads are:—

39½″ with a spread of 41″ in 1902.
40″ in 1908.
40½″ in 1914.
39½″ in 1920.

Nothing over 38″ appears to have been obtained for a good many years, the deterioration in size being probably due to the best stags being shot off year after year. Most stags drop their horns in April but a few are to be found in hard horn throughout the year. 'Sore neck' seems to be confined to the low country but even there it is by no means universal. An outbreak of foot and mouth disease at the foot of the Northern slopes in 1916 caused the death of several sambur. Except for this and the previously mentioned outbreak of rinderpest at Mudumalai in 1909, they appear to have remained healthy.

Chital are confined to the low country, their favourite centre being the Mudumalai and Benne forests. In spite of the appalling ravages of wild dogs and to a lesser degree of tigers and panthers, large herds of 30 to 40 may be seen including a number of fine stags. The way in which chital heads have improved under a careful system of preservation is shown by the following instance. Writing in 1880 a well known local sportsman and taxidermist refers to a head of 32½″ which he had recently obtained as the largest shot to date in South India. Nowadays such horns are common in the Nilgiris and heads of 34″ and 35″ can be obtained without difficulty while several over 37″ have been shot in recent years, the best being 2 of 38″ bagged in 1915 and 1926. Old stags almost invariably have false points, measuring as much as 3″, at the junction of the brow and the main antler. The present horn limit of 28″ was fixed for the same reason as in the case of sambur and also because of the great difficulty in judging the length owing to variations of curve.

Unlike sambur, chital are very irregular in shedding their horns and consequently some may be found in hard horn and others in velvet during every month of the year. The majority are however clear of velvet early in June and it is then that the stags may be heard roaring, and stalked.

Considering that the number on the licence has been reduced from four to three and then three to two the total brought to bag each year cannot be considered unsatisfactory. Indeed it is rather a matter for wonder that so many fine heads can be obtained year after year from such a limited area.

The great majority of the stags shot come from the Mudumalai Forest and if the proposal to turn that area into a Sanctuary is accepted by Government it may be necessary to reduce the present bag limit from two to one.

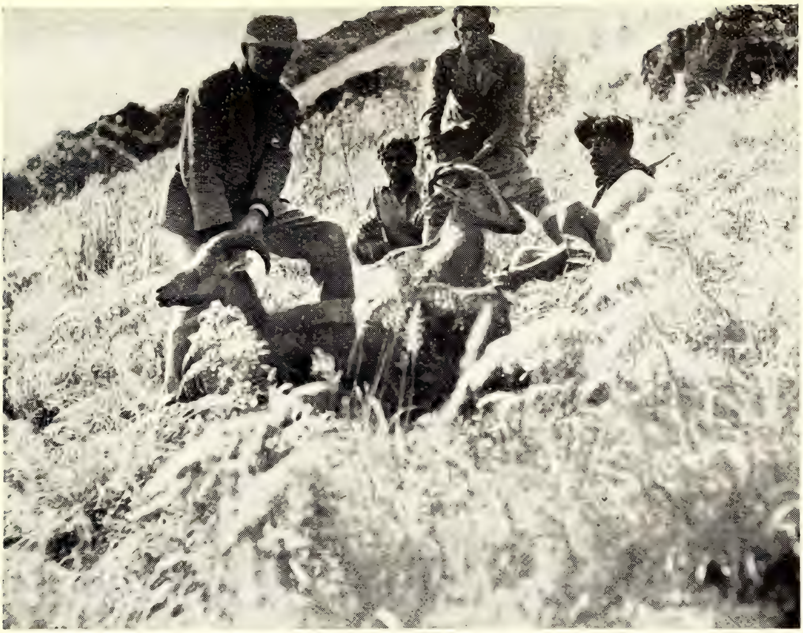
The Nilgiri Tahr is found nowhere except on the mountain ranges of S. India and in the Nilgiris its chief habitat is on and above the cliffs of the uninhabited Kundahs. In 1879 when the Association was formed, its numbers, due to indiscriminate shooting, probably did not exceed a dozen head all told—now there are certainly not less than 500; the numbers bagged in recent years show how they have increased.

'Saddle backs' which alone may be shot are so called from the conspicuous white saddle mark on the back which develops with age; this saddle is more prominent at certain seasons than at others but once attained is never lost. The best horns recorded for many years measured 16¾″ and were obtained in 1916; nothing over 15″ has been shot in recent years. Ibex suffer much from the depredations of panthers, and also to some extent from wild dogs when they are lured away from the vicinity of the cliffs by the sprouting of the young grass in April.

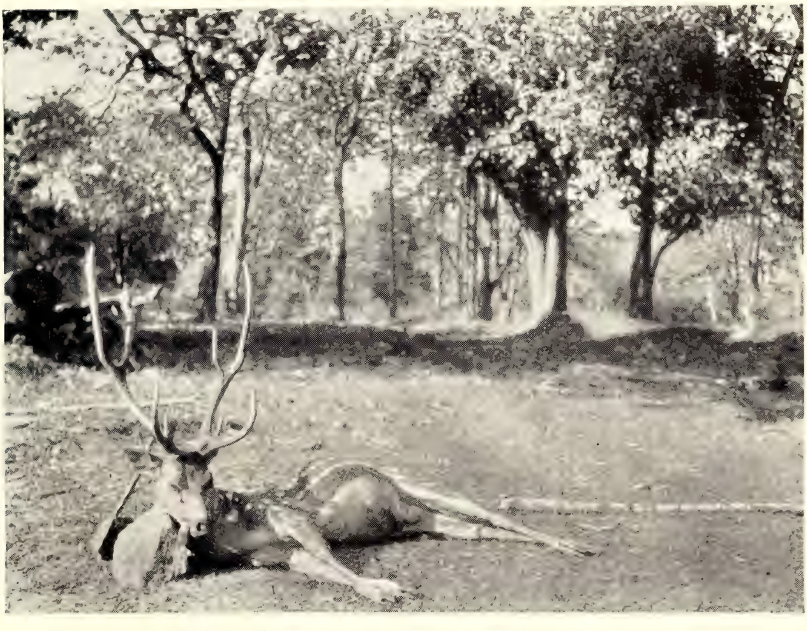
The Black Buck of the Nilgiris is much smaller in build than those found in Central India and the horns seldom exceed 17″ in length. The record head for the Nilgiris is believed to measure 21½″ but the largest of which any mention is made in the Annual Reports is 19½″.

For several years their shooting was closed and there seems little doubt that they need renewed protection, as they suffer severely at the hands of patta land shooters and from wild dogs.

Tigers on the plateau and also at Mudumalai are more often than not met by chance thus offering the sporting opportunity, so seldom obtained elsewhere, of shooting them on foot. General



Nilgiri Tahr (*Hemitragus hylocrius* Blyth).



Chital (*Axis axis* Erxl.) shot at Mudumalai.
Length of horns 37″.

Hamilton recorded meeting a family party of 5 in the Kundahs and the writer had the good fortune to encounter 3 on the path near Bangi Tappal some years ago, a sight never to be forgotten. Only round Anaikatti and Masnigudi is the orthodox practice of tying out baits and beating regularly resorted to. There seems to be no decrease in their numbers either on the plateau or in the low country, fresh animals turning up in a short time to replace those shot.

Ten foot tigers are as rare in the Nilgiris as elsewhere but they do occur occasionally. The largest *verified* measurement appears to be one of 10′ 2″ between pegs obtained at Mudumalai in April 1939; this magnificent specimen was stiff when taped; so must have measured even more before rigor set in. Another very fine tiger only slightly less but with a longer tail was shot at Mavinhalla in July 1939. It is interesting to record that this animal passed the gun in a beat chasing a fine sambur stag, both animals being fully extended and separated by only a few yards.

Tigers from the Nilgiris as a rule have coats of a deeper colour and more heavily marked than those from Central India, but so far a 'royal' tiger, i.e. with an unbroken black band, does not appear to have been obtained.

Panthers have decreased on the plateau in recent years with the result that wild pig have increased enormously and cause very serious damage to crops, more especially potatoes. In the low country they appear to be as numerous as ever no less than 7 having been shot round Anaikatti and at the foot of the Sigur ghat between April and July 1939.

The largest recorded measurements *between pegs* are 7′ 9″ in 1900 and 7′ 10″ in 1919. Animals between 8′ 1″ and 8′ 6″ have been reported but there seems little doubt that they were measured round the curves. Black panthers are still brought to bag occasionally and have been reported in 1939 both on the plateau and in the Wynaad.

Sloth Bears from the table seem to be on the decrease but it is doubtful whether this is really so as they are very nocturnal and have never been numerous.

They are found chiefly in the low country and on the Northern and Western slopes but seldom ascend to the plateau.

Barking Deer (locally termed Jungle Sheep) are found mostly on the plateau but they occur also in the Nilgiri Wynaad. The number allowed on the licence was reduced from six to four in 1929 but the table shows that their position is satisfactory.

The best head recorded is one of 6½″ in 1898. A pure albino specimen was shot on Doddabetta in 1938.

Elliot's or *the Mountain Antelope*, as the Four-horned Antelope used to be termed locally is found chiefly at the foot of the Northern slopes and in the broken ground covered with light jungle along the edge of the Mysore Ditch, as the great rift of the Moyar river is called. They are few in number and seldom shot.

Usually the posterior horns alone are present and a measurement of 3½″ would be above the average though one of 4½″ was bagged in 1918. The latter which must have been an exceptionally old buck shows about $\frac{1}{4}''$ of one front horn.

Two of these antelopes are reported to have been shot many years ago at Pykara but since then it has not been seen on the plateau.

Hyenas. Except for an occasional straggler to the plateau these unsightly but useful scavengers are confined to the dry belt at about 3,000 feet elevation round Anaikatti where they are common. Poor as the trophy is their skins are certainly far finer than those from further North.

From the writer's own experience a hyena will keep a female or small male panther from its kill but gives way to a large male.

One is recorded as having been killed on the plateau by the Ooty Hunt in 1910.

Nilgai are probably now extinct in the area, though it is just possible that one or two remain in the broken country East of Sirur at the foot of the Northern slopes, which is seldom visited by sportsmen. None however have been reported for many years.

Elephants are protected by the Elephant Preservation Act but most years one or more solitary tuskers which have been damaging crops or endangering human life are proscribed by the Collector and permits to shoot them issued to Nilgiri Game Association licence holders on the recommendation of the District Forest Officer. Proscriptions last only for twelve months and lapse if the animal has not been shot within that period; between 1931 and 1939 ten tuskers were proscribed and eight shot.

The movements of elephants depend largely on climatic conditions but there are always a few to be found in the jungles at the foot of the Northern slopes while at times their number rises to fifty or more. The Forest Department maintains a number of elephant pits at Teppakadu where animals are trapped from time to time.

The droppings of a herd of elephants were found in 1929 on Angindamalai a peak in the distant Kundahs at a height of 7,300 feet—probably they come up annually via the Silent Valley. But nowhere else are they seen nowadays on the plateau if we except a small lost calf which somehow found its way up and was captured on the Ooty Golf Course some ten years ago.

Other species: So far as is known no exotic animals have ever been introduced by the Association. A proposal some thirty years ago to import the young of African antelopes was rejected by the Committee on the ground that the money might better be expended on indigenous species.

More recently a sugestion to acclimatise gooral was approved but nothing further appears to have been done in the matter. There seems little doubt that the experiment would prove a success and would add an interesting variety to the existing fauna.

Small game. For many years the close season ran from 1st March to 15th September, and as long as this was maintained a fair head of small game was to be found on the plateau, the stock of Jungle Fowl being maintained by releasing birds caught in the

Solitary tusker near Anaikatti.

Rogue shot at Benne, 1937.

low country. But in recent years the close season has been whittled down and at present pigeon shooting opens as early as 1st July while migratory birds may be shot up to the end of March. The former results in nesting Jungle Fowl being disturbed while the noticeable decrease in Woodcock is possibly to some extent due to the birds being shot after they have paired prior to migration. There are two well recognised principles of small game preservation viz. destruction of vermin and conservation of breeding stock. The first has been well looked after, but it seems probable that unless more attention is paid to the latter the stock of small game on the plateau will soon be so reduced as to afford little sport.

In the low country however matters are in a much more satisfactory condition and there are still plenty of Peafowl, Jungle fowl, partridges and hares in spite of heavy shooting.

Complaints a few years ago that game birds and hares were dying as the result of eating the cochineal insect which had been introduced into the low country to destroy the prickly pear, seem to have been unfounded, though the absence of such heavy cover has certainly deprived the birds to some extent of nesting sites.

Many attempts have been made to improve the small game shooting on the plateau, by limiting the shooting to two days a week, by closing certain areas some temporarily and some permanently as nesting sanctuaries and by planting crops in their vicinity, by breeding birds from eggs collected in the low country, by releasing imported jungle fowl and other species and by giving protection to jungle hens, but none have proved really satisfactory.

Exotic Fauna. The Association has from time to time spent large sums for importing exotic birds but they have never become acclimatised and have all died out.

Chikor. 39 were imported in 1892 but died out. Between 1910 and 1916 no less than 90 were imported from Quetta but shared a similar fate.

See-see. 8 were imported in 1911 and 11 in 1916, but disappeared.

Red Jungle-Fowl. 7 were imported from Ganjam in 1901—they were kept in captivity and bred from, 74 of their progeny being turned down between 1903 and 1907; no traces of these are now to be found.

Ceylon Jungle-Fowl. 5 were imported and turned down in 1906.

Guinea Fowl. 6 were imported in 1893; but the experiment proved a failure and it was decided in 1895 not to repeat it.

Pheasants. 12 English pheasants were imported in 1892, and some Himalayan pheasants before the date, but none survived. An attempt to obtain Silver Pheasants from Burma a few years ago fell through as it proved impossible to obtain either eggs or birds.

Peafowl. 10 from Godaveri were turned down on the plateau in 1901 but by 1903 they had all made their way down to the low country or been killed by vermin.

Francolin. A recent proposal to import Francolin from East Africa fell through owing to the breakdown of arrangements at the last moment. In view of previous experiences it is doubtful whether they would have proved any more successful than other species already tried.

Rabbits. Appear to have been imported and turned down many years ago, as in 1892 it was reported that they had proved a failure. It is perhaps just as well that no further attempt has been made to repeat this somewhat risky experiment.

AMOUNTS PAID FOR DESTRUCTION OF VERMIN.

Year	Amount	Wild dogs destroyed
	Rs.	
1912–13	1,420	58
1913–14	1,112	46
1914–15	787	35
1915–16	850	35
1916–17	657	22
1917–18	1,200	56
1918–19	1,023	46
1919–20	897	41
1920–21	1,415	62
1921–22	1,773	52
1922–23	4,192	93
1923–24	677	12
1924–25	...	... No figures available.
1925–26	195	20
1926–27	434	36
1927–28	1,254	... No figures available.
1928–29	1,312	...
1929–30	471	...
1930–31	909	...
1931–32	525	16
1932–33	587	15
1933–34	1,295	30
1934–35	943	18
1935–36	751	16
1936–37	1,230	48
1937–38	670	28

VERMIN.

The accompanying table shows the amounts paid by the Association during the past 26 years for the destruction of vermin, included under that head being wild dogs, wild cats, red mongooses, martens, crow pheasants, sparrow hawks, marsh harriers, etc.

Owing to the fact that small, if any, rewards were paid in adjoining districts, the Association has from time to time been flooded with skins, many of which must have been imported. This reached its peak in 1922-3 when no less than Rs. 4,192 was disbursed and to avoid bankruptcy all rewards had to be temporarily discontinued. They were however resumed on a reduced scale in 1925-26 with various modifications since, the rewards as at present being Rs. 20 for a wild dog, Rs. 1-8 for a wild cat or red mongoose and 8 annas for a crow pheasant; except in the case of wild dogs rewards are paid to licence holders only. The marked variation in the numbers of wild dogs killed from year to year, is due partly to the reason already given but also doubtless to the periods of decrease and increase to which these animals are liable. Whether such decreases are due to disease is not known but certainly some of the wild dogs killed in 1937 were in a very mangy condition, and a number were found dead probably from distemper in 1893-4, sometimes as many as 3 and 4 together in one spot.

The idea that wild dogs drive all game from the forests though true enough of open jungle does not apply to forests like Mudumalai where the heavier jungle and tall grass (which cuts the dogs' pads) affords a safer refuge to their victims. There chital may be seen daily even when wild dogs are hunting the area without remission.

POACHING.

This of course can never be entirely suppressed but it is kept within bounds by the Nilgiri Game Association watchers and by the subordinates of the Forest Department who receive rewards for the detection of satisfactorily proved offences. Some dozen or more cases are reported annually the majority of which result in conviction. One of the most difficult types to deal with is the motor car poacher who shoots by night but certain steps have been taken to deal with this despicable offence which it is hoped will prove satisfactory.

The greatest deterrent to poaching is undoubtedly the law forbidding the sale of game out of season anywhere in the district, however it may have been obtained.

FISHING.

Many attempts to establish trout in the Nilgiris were made in the past by the Nilgiri Game Association and by private enterprise at great cost, but for various reasons all proved failures and not until 1906 when on the suggestion of the Nilgiri Game Association the services of Mr. H. C. Wilson were obtained from Ceylon was any real progress effected. Government took over the trout fishing in 1909 and under Mr. Wilson's expert guidance Rainbow trout were introduced, and by 1911 trout fishing in the Nilgiris had become an accomplished fact. In 1926 the Nilgiri Game Association at the request of Government resumed control of the fishing on the plateau and since then has been entirely responsible for it. A season licence costing Rs. 100 entitles the holder to 250 trout and a daily license of Rs. 5 to 10 trout. There are also licences for the month, week and weekend. Coarse fishing licences covering two streams stocked with trout and carp cost Rs. 25 for the season or Rs. 2 per diem.

The following table shows the numbers of trout and carp killed on the plateau between 1927 and 1938; carp and mahseer killed in the Moyar and Bhavani have been excluded as these rivers are not under control of the Association.

TABLE OF FISH KILLED IN THE NILGIRIS.

Year	Trout	Carp	Revenue from licences
			Rs.
1927	3957	82	5,280
1928	3440	136	6,829
1929	2968	167	6,239
1930	3145	108	6,393
1931	3303	72	6,965
1932	4321	52	4,554
1933	4393	51	5,439
1934	6742	75	6,688
1935	8191	49	7,428
1936	6828	44	7,965
1937	4003	37	7,329
1938	4705	52	7,376

The large numbers killed in 1934-6 are due chiefly to a great increase in the number of small fish; since their reduction weights have generally improved. The figures for 1938 include 399 trout of 1 lb. and over, 375 of 1½ lbs. and over, 214 of 2 lbs. and over, and 11 of 3 lbs. and over—most of these came from the Mukerti lake, the average for the rivers being 3 to the lb.

The chief problem with which the Nilgiri Game Association is faced is the provision of a sufficient food supply for the trout. The indigenous fresh water crab provides much of this, and it has been supplemented by the formation of watercress beds into which have been introduced fresh water shrimps and snails, and by planting trees and shrubs along the river banks likely to attract Ephemeridæ. In addition the rivers are fed with the meat of sambur hinds shot during the hot weather when the natural food supply is low.

The Association maintains an up-to-date hatchery at Avalanche and in it are bred trout from locally collected ova supplemented from time to time by importation. There are also stew ponds at Avalanche, Krurmund and Pykara where small fish are kept till they are large enough to be turned into rivers. Besides maintaining the trout fisheries of the Nilgiris the Association has been able to supply trout for stocking rivers to the Palni Hills and the High Range of Travancore.

FINANCE.

The finances of the Association are derived almost entirely from licence fees for shooting and fishing. On the debit side are the salaries of the Fishing Superintendent and of the game and fish watchers, office establishment, rewards for vermin, upkeep of

The Mukerti Lake.

Ten Mukerti Trout = 15 lbs. 9 oz.

hatchery and stock ponds, river improvements, upkeep of bungalows and watchers' quarters, maintenance of boats on Mukerti lake and shooting improvements generally.

Generally speaking receipts balance expenditure, but the small reserve which had been built up over many years has been almost entirely swallowed up by the erection of the new Mukerti shooting and fishing hut to replace the old one submerged by the recently formed Hydro Electric Lake for which no compensation has been received from Government.

At the beginning of 1939 the Association was asked by Government to show cause why it should not surrender half the shooting and fishing fees. The matter is still under discussion but it is hoped that the well reasoned arguments of the Association will have the desired effect, as without the present receipts it would be quite impossible to run the shooting and fishing efficiently. It is hoped also that the decisions of the All India Wild Life Conference held a few years ago whose policy has already been accepted by Government will be given due consideration.

GENERAL.

For the convenience of members, the Association maintains three well equipped shooting and fishing bungalows on the plateau, two of which were presented by members on retirement, and another smaller one at Mudumalai. The block system is not in force in the Nilgiris and so far has proved unnecessary. The unwritten law that the man first on the spot has prior claim and should not be disturbed, in accordance with etiquette prevailing among sportsmen, is generally recognised.

For the benefit of visitors there are on sale at the office of the Association Notes on shooting and fishing and an up-to-date shikar map showing all roads, bungalows and streams in the area. An experiment in registering local shikaris was tried for several years but proved a failure owing to lack of support.

A proposal two years ago to abolish the close season for big game was, one is glad to record, unanimously rejected by the Committee. The plea that the constant presence of sportsmen is the best check on poaching is no doubt true but in this small and well policed area already there is a continual flow of sportsmen either shooting or fishing throughout the year. It must also be remembered that the Nilgiris is under present conditions shot to its limit and if the existing four months close season for big game was abolished it would mean an increase of at least 30 per cent to the numbers of animals killed annually, which would only result in deterioration and the reduction of the bag limit. In addition the law prohibiting the sale of game out of season would lapse and poaching would increase. There seem therefore to be no reasonable grounds for abolishing a system which has worked so well for sixty years.

In 1936 a proposal to alienate the whole of the Mudumalai forest from the Nilgiri Game Association and to turn it into a

National Park was put forward by the Chief Conservator of Forests. This suggestion was most strongly combatted by the Association as economically unsound and also unfair to the Association (which had already been deprived of large areas in the Kundahs) as it took away what is admittedly the best shooting ground in the low country.

In 1938 the Chief Conservator submitted a revised plan covering a smaller area as a Wild Life Sanctuary in which timber extraction would continue while control would be vested in the existing Forest staff; and it is understood that this scheme will shortly come into effect.

With the idea of preservation no one interested in the Fauna of the country can find fault, the only question is in the method employed. National Parks on the lines of those in South Africa and America are unsuited to India as the fees from visitors will be so small; while sanctuaries unless adequately policed merely form a happy hunting ground for poachers, as has been found in other parts of India.

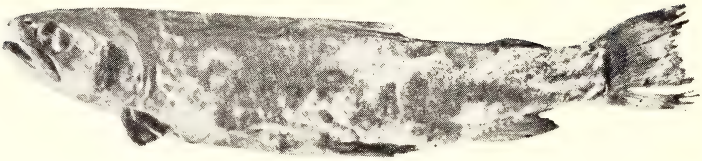
As long as the Association exists the supervision it exercises and constant presence of sportsmen provide a guarantee for the preservation of the fauna, but fears have been expressed that the Association's days are numbered and that it is advisable now to take steps to safeguard the wild life of the district before it is too late.

If the scheme comes into force it is of the utmost importance that a really effective system of policing should be maintained.

CONCLUSION.

Such has been the record of the Nilgiri Game Association for the past sixty years, a record of which it may well be proud. Starting with a Fauna in the case of some species on the verge of extinction, it has by careful control built up as fine a stock of game as is to be found anywhere in India, while the popularity of the fishing is evidenced by the large number of licences which continue to be sold.

But the future is not so rosy. Apart from the possible loss of half the licence fees which would result in financial ruin, there still persists the butcher mentality of the 70's which given free rein would abolish all close seasons and allow indiscriminate shooting. It is to be hoped that Government will see reason and that the more far seeing members of the Association will continue to exercise a restraining influence over those imbued with blood lust. It would be a thousand pities if 60 years of good game preservation should come to nothing; surely it is not too much to expect that all members present and future will bear in mind the declared object of the Association which is the *preservation* of game and not its destruction.



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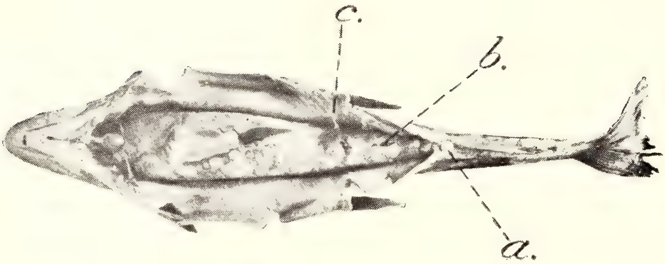

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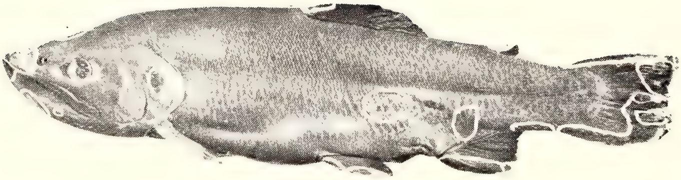

3.

Brown and Rainbow Trout from Kashmir.

(*For explanation see end of article*).

ON AN EPIDEMIC AMONG RAINBOW TROUT IN THE HARWAN HATCHERY, KASHMIR, DURING 1934; WITH OBSERVATIONS ON CERTAIN RECENT CASES OF MORTALITY.

BY

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(*With 2 plates and 1 text figure*).

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INTRODUCTION.

At the suggestion of the Bombay Natural History Society the Zoological Survey of India was approached telegraphically in April, 1934, by the Game Warden, Jammu and Kashmir State, to suggest ways and means for avoiding the heavy mortality among Rainbow Trout in the Harwan Hatchery, Kashmir. Rai Bahadur Dr. S. L. Hora, who attended to the enquiry, suggested, as a preliminary measure, a general improvement in the sanitary conditions by the removal of any excessive plant growth and disinfection of pens with Condy's fluid. At the same time he asked for a few dead specimens for *post mortem* examination, and detailed information regarding the symptoms of the disease and the conditions under which the fish are kept in the hatchery. Three specimens of Rainbow Trout and an accompanying note (*vide infra,* pp. 405-407) from Brigadier A. Campbell Ross about the Hatchery were received. An examination of the specimens showed a number of external injuries in the case of all the three specimens, which were attributed by Dr. Hora to the spawning activities of the individuals affected. Further it was presumed that death may have resulted from fungus attack of the injured parts and its subsequent spreading to other portions of the body. However, by the 8th of May the mortality was checked with the increase in the water supply and later almost stopped by taking out all the fish from the most affected tanks, drying the tanks and treating them with a strong solution of Condy's fluid. In view of the healthy conditions having been restored, Dr. Hora did not pursue investigations any further, but in June 1938, he very kindly placed all the material at my disposal and suggested that I should prepare a report on the epidemic of 1934 in the Harwan Hatchery. In writing this report I had the additional advantage of having worked in the Kashmir hatcheries for about two years.

I am grateful to Dr. Hora for affording me an opportunity to investigate this interesting material, and for his helpful suggestions. To Dr. Baini Prashad, Director, Zoological Survey of India, I am indebted for facilities for work in the department and for valuable criticism. I have received valuable information and material from the Game and Fisheries Division of the Forest Department, Kashmir, and for these I am obliged to the authorities concerned, particularly to Sir Peter H. Clutterbuck, Chief Conservator of Forests, to whom I am further indebted for encouragement and manifold courtesies.

DESCRIPTION OF THE MATERIAL.

The material consisted of 3 specimens of Rainbow Trout—one male, 390 mm. in standard length and 2 females, about 400 mm. in standard length. The fish died on the 20th April, 1934, and were preserved in formalin. Later, however, they were transferred to rectified spirits of wine. Owing to the preservation of the specimens it is now difficult to verify some of the diagnostic features of the disease as given by Brigadier Ross (*vide infra*, p. 406) but in the following paragraphs I have attempted to correlate the symptoms described by him with the results of the detailed *post mortem* examination of the specimens.

Pop-eye or *exophthalmia.*—Though in the preserved material the bulging eye-balls are not readily noticeable, their deep sunken condition and the presence of loose flaps of skin round the eyes indicate that, at one time, they may have protruded considerably beyond the sockets. The opacity of the eyes is distinctly marked in all the three specimens. In one of them, there are clear marks of injury to the anterior side of the right lens; while the cornea of the left eye is perforated and the lens is absent. In the other specimens both the eyes are opaque with definite marks of injury to the lens of the right eye.

According to Davis (1937, p. 65-67), the Pop-eye condition in trout results from a number of causes, which may here be considered one by one.

1. A severe infestation with the larvae of a trematode worm.

An examination of the eyes showed no evidence of trematode infestation, and, moreover, in the Harwan Hatchery there are no snails, which could serve as the principal host of any trematode. It is unlikely, therefore, that the pop-eye condition can be attributed to this cause.

2. Water supply being supersaturated by air gives rise to gas, which causes bulging of the eye-balls.

At Harwan the ponds are fed by an open snow-fed stream and, in consequence, there is no natural supersaturation of the water by air or gas.

3. Accumulation of serous fluid in the abdominal cavity and other parts of the body.

This is the common cause of pop-eye in trout, and is usually associated with the diseased condition of the kidneys which, in the affected specimens, become darker owing to the tubules being filled with crystals and casts. Heavy infestation of the kidneys with a Myxosporidian parasite also produces the same symptoms. In the specimens under report the kidneys were normal and there was no accumulation of serous fluid in the abdominal cavity.

4. Bacterial infection of the eye.

Bacterial infection, though not well established, is usually seasonal and the mortality due to this cause is confined to spring and early summer. It affects chiefly the adult fish. The usual symptom is the appearance of bubbles or blisters on the surface of the body usually above the lateral line. No such blisters, however, were noticed in specimens under report.

5. Lipoid degeneration or fatty degeneration of the liver.

Lipoid degeneration, which in itself is a serious disease, has been observed to cause exophthalmia or protrusion of the eye-balls (Davis, 1937, p. 69). Diseased fish are darker in colour and float restlessly at the surface. The gills, due to a marked anæmia, are lighter in colour. The stomach and intestine contain little, if any, food and are filled with a pale yellow fluid. The body cavity is frequently distended. The striking characteristic is the condition of the liver which is light yellow or yellowish grey. The colouration may be uniform, but not infrequently the liver gets covered with dark blotches scattered at intervals. According to Davis this disease is mainly confined to Rainbow Trout.

The *post mortem* examination of the specimens revealed that the viscera were highly loaded with fat. In one case the liver was slightly yellowish, while in the other two it was light yellow, excepting the region near its point of attachment which was blackish. The size of the gall bladder was normal in the male, while it was enormously distended in the two females. The fluid in the gall bladder was found to be condensed into small, yellowish green masses. The variability in the size of the gall bladder noticed in the Harwan specimens is not, as remarked by Davis, an unusual occurrence.

The stomachs and intestines of the specimens were almost empty. In one female the intestine contained greasy fluid of a yellow colour condensed into fat-like globules. The mesenteries of the stomach, intestine and its cæcæ were heavily loaded with fat.

Though the colour is not well preserved in these specimens, the body appears generally darker. It may be noted that Brigadier Ross referred to the black colour of the body and the anæmic condition of the mucous membrane in the mouth as the symptoms of the disease. As indicated above, these two symptoms are highly characteristic of the disease caused by a fatty degeneration of the liver (Davis, 1937, p. 69).

In view of the above it seems probable that the pop-eye condition in the affected Rainbows was induced by the lipoid or fatty degeneration of the liver, due to the replacement of normal glycogen in the cells by a large accumulation of fat or lipoids. The fat, when in great excess, may also get deposited over various organs, as noticed in these specimens. The accumulation of too much fat normally results from malnutrition, but from the data supplied by Brigadier Ross there would appear 'nothing apparently wrong with the fish given as food'. It is, however, probable that the country fish from the Dal Lake, comprising species of *Crossochilus, Botia,* and *Schizothorax,* were rather rich in fat as most of them breed in the summer months. No definite data are available about the food and nutrition value of these species but as their local names indicate they are regarded highly fatty and slightly bitter in taste especially *Crossochilus.* Normally this type of fatty food may not affect healthy fish, but, as has been detailed below (*vide infra,* p. 402), the trout were living under unhealthy conditions in 1934 and this may have been responsible for their assimilating too much fat in their livers.

The injuries to the lenses noted above are in all probability accidental and may have been caused during the handling of the fish by the catchers. Brigadier Ross reported that the eyes were first protruded, but this condition later subsided. In this connection reference may be made to Bullin (1913, p. 634), who, quotes Hoffer's remarks that in the case of fish weakened by disease or in a dying condition the organs of sight are deeply sunk in their orbits whereas in healthy fish the eyes somewhat protrude and that incipient corneal opacity may sometime be taken as a diagnostic feature of graver disorders. For opacity he gives concussion as the chief cause, and remarks that the aqueous humour accumulates more in the anterior chamber resulting in the bulging out of the cornea. He has also indicated that the perforation of the cornea is largely due to the susceptibility of the fish, already weakened by disease, to injury. He is further of the opinion that in trout it may be due to their living in waters impregnated with iron. In the Harwan Hatchery iron screens are used in the pens, but there is the least probability for this factor as a causative agent owing to the fact that cases of trout with perforated cornea are very rare and that same screens and water are used for other fish which do not get affected. This may be an additional factor, but requires further investigation.

Edges of fins ragged and turned white.—The next point in Brigadier Ross's description of the disease relates to the edges of the fins getting ragged and turning white.

Of the three specimens examined, the large mature male with secondary sexual characters fully developed, has both the jaws injured. The lower portions of the caudal, anal and pelvic fins are also injured. In the other two specimens, both of which are mature females, the jaws and the anal fins are only slightly injured, but the caudal fins are greatly damaged. From the nature of the injuries it seems probable that this is the result of sexual excitement. The injuries to the fins must have resulted from rubbing against the bottom of the pens preliminary to spawning.

The growth of fungus is usually accelerated by temperature and unhygienic conditions. Injuries of the type noted above, form suitable nuclei for the attack of fungus in fishes living under artificial conditions that prevail in hatcheries. From such focii the fungus later spreads to other living tissues.

As according to Brigadier Ross's report the pens at Harwan Hatchery were silted up to a depth of six inches, there is every probability that the resulting insanitary condition of the pens was in some way responsible for the ragging and fraying of the fins. In this connection reference may be made to the observations of Major Pyper, Residency Surgeon, who visited the hatcheries and examined fresh specimens. His examination of the ulcerated fins did not reveal any infection even under a high power of microscope, and it can, therefore, be safely concluded that the injuries to the fins were due, in the initial stages at least, to mechanical causes.

Large white marks below the gills.—Brigadier Ross also noted the presence of white marks below the gills. An examination of the specimens shows that there are a number of white spots or patches due to injuries over the body of the male specimen. Microscopic examination of scrapings from these patches did not reveal any type of infection.

Dr. Hora on receiving the specimens marked the white areas, which were in his opinion attacked by *Saprolegnia,* with white rings in the male specimen (Plate fig. 3). Though there is no evidence in the preserved specimens of the fungus in these regions I have personal experience of fungus causing considerable damage to trout in the Harwan Hatchery, Kashmir.

GENERAL CONSIDERATIONS AND CONCLUSION.

From the nature of the material it seems reasonable to assume that the injuries to the fins and other parts of the trout had probably been caused by sexual activities. The presence of ripe males and females in the same pen, and over-crowding may have been additional contributory factors. Occasionally injury is also caused by the netting of the fish for stripping manipulation or sale. Further, under favourable weather conditions any small injury may be sufficient for the *Saprolegnia* to attack fish.

According to Davis (p. 63), there is no evidence to show that fungus grows on healthy specimens unless there is some foreign organic matter adhering to the surface, while it develops quickly on dead and injured parts. Rushton (1935, p. 52) is of opinion that an excessive number of fish in an area results in causing abrasions and loss of scales which allow the fungus to get a hold.

Further, the presence of fungus is an indication of organic pollution. According to Brigadier Ross silt, probably containing organic débris, had accumulated from 3-6 in. deep in the pens at Harwan, and the pens were also over-stocked. For example, the affected ponds Nos. 4 and 5 with dimensions of 48 ft. by $5\frac{1}{2}$ ft. by $5\frac{1}{3}$ ft. and 46 ft. by $5\frac{1}{2}$ ft. by $5\frac{1}{2}$ ft. held 95 and 45, 3-4 and 4-5 years old fish respectively in 1934. Owing to drought there was shortage of water in the pens for several months preceding the epidemic. According to Major Pyper, filth had accumulated round the village over and above the hatchery during the earlier part of 1934, and with the onset of rains after March, this was washed into the stream and later into the pens.

It may also be pointed out that pen No. 5, which was most affected, is located at a place where the water is deepest and the current relatively much slower. In consequence the maximum amount of silt is collected in this pen. In pens Nos. 9 and 10, which held Brown Trout, on the other hand the water flows at so rapid a rate that any food thrown in at the upper end, if not ingested by the fish immediately, is carried to the lower end. It was probably for this reason that the Brown Trout were least affected.

Brigadier Ross further wrote that the disease attacked the males more virulently than the females. As has been explained above the males, under the urge of sexual excitement, are liable to receive more injuries and wounds during sexual combats than the females. Further, it is the males that struggle most while the milt is being taken out, and often slip off and get injured. Regarding the observation that it was the bigger trout among which the maximum rate of death occurred, while yearlings and 2-year old ones were apparently immune, it may be stated that here again the sexual maturity of the larger specimens explains the difference. Further, young fish, as a general rule, possess greater vitality, vigour and health. Another curious feature of the disease was that Brown Trout of the same age in the same hatchery had not been affected. This may be due to the fact that fatty degeneration of the liver, as noted by Davis, is confined to Rainbows only, while Browns are practically immune from it.

It may be concluded that whereas lipoid disease is a result of malnutrition, food was not the only factor responsible for the epidemic; for the fish had already been weakened by adverse environmental conditoins such as low water, overcrowding and unhygienic conditions of the pens. The malady was aggravated by the breeding season during which all reserves are used up for the proper development of the sexual glands. The sexual combats and efforts at spawning caused injuries to the fish and the then unhealthy condition of the pens made the fish liable to extensive attacks by fungus.

Recent cases of mortality.

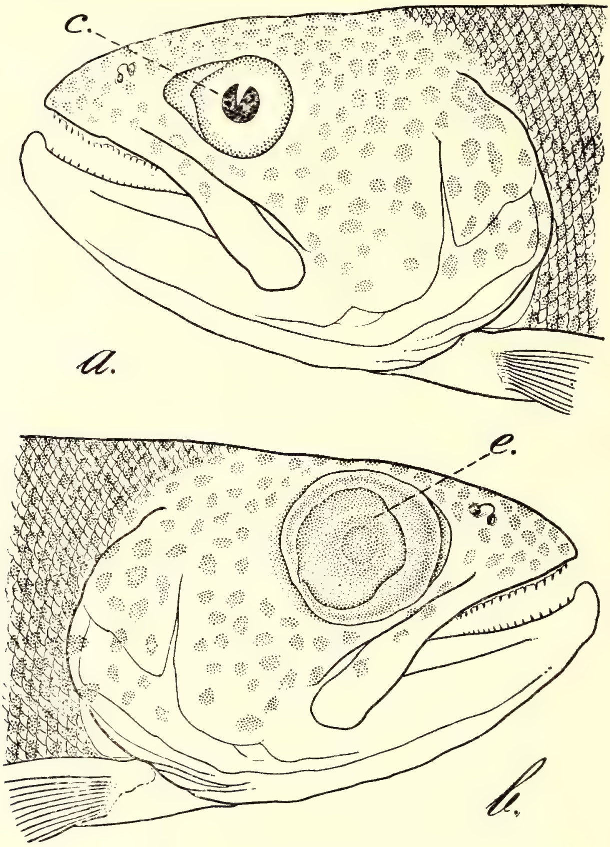
In June 1938, Sir Peter H. Clutterbuck, Chief Conservator of Forests, Kashmir, was requested to send cases of Rainbow Trout mortality in the Harwan Hatchery, Kashmir, in order to verify the data already available for the investigation of an epidemic among Rainbows in 1934. Accordingly, the Game Warden sent a collection of two Rainbows and one Brown Trout, each two years old, without any remarks regarding the circumstances of their death. As a result of *post mortem* examination, symptoms of fatty degeneration of the liver were observed in the two Rainbows, while the Brown Trout appeared to be a case of malstripping.

Fatty degeneration of the liver.—An external examination of one of the Rainbow specimens, 245 mm. in standard length, showed that it was somewhat blackish in colour and had a mark of an injury, with loss of scales and skin, over the posterior portion of the pectoral fin above the lateral line. These injuries seem to be the result of netting or other mechanical causes. The right eye appeared to be quite normal, but the left showed marked protrusion or exophthalmia. Internally a great deposition of fat in the mesenteries and along the entire length of the alimentary canal was observed. The liver was yellow with dark blotches on its outer border. The rest of the organs were normal, except the kidneys that appeared blackish in colour. The air-bladder contained fat globules. The dissection of the abnormal eye showed that the opaque cornea was greatly thickened by a deposition over it of a tissue-like matter which could be removed by means of a fine pair of forceps. According to Bullin (1913, p. 636) aqueous humour accumulates in large quantity in the anterior chamber and results in the bulging of the cornea outwards.

The second rainbow, 240 mm. in standard length, was more blackish in colour. The right eye was enormously enlarged and protruded (text-fig. 1 *b*). On dissection it was found that the lens had moved much forward, and almost touched the cornea. There were indications of fatty deposits in the eye-ball. The left eye, though normal in size, had a perforated cornea and the eye was without its lens. The perforation of the cornea (text-fig. 1*a*), according to Bullin (1913, p. 634), results from the existence of fish in waters impregnated with iron from drains, or from injury. The former, however, cannot account for the defective eye of a trout in the Harwan Hatchery as such cases are very rare and the fish as a rule do not suffer from such defects. In the present specimen, however, the pressure of fat from behind, as is characteristic of the disease, has probably thrown out the lens bursting out the cornea, for in the right eye, as observed already, there is still indication of the forward position of the lens and deposition of the fat in the posterior chamber.

An internal examination of the viscera revealed almost the same symptoms as noted in the first case, except that the liver had degenerated and was greatly reduced in size. The amount of fat deposited was in excess of that observed in the previous specimen. The stomach and intestine were empty.

In my opinion the fatty degeneration of the liver may have been caused by feeding the fish on fatty diet, as already indicated in the foregoing account. The diet of the fish is reported to be the same as it has ever been, but from my experience of the Harwan Hatchery I know that trout are fed on country fish from the Dal Lake belonging to the genera *Crossochilus, Botia* and *Schizothorax*. During summer when species of *Schizothorax* are not easily available in the Dal, *Botia*, and *Crossochilus* form the bulk of the food-supply.



Text-fig. 1.—Lateral views of head and anterior part of body from the left and right sides of a Rainbow Trout that died in the Harwan Hatchery, Kashmir in 1938. *Nat. Size.*

a. Showing perforation (*c*) of the cornea of the left eye; *b*. Showing enormous protrusion (*e*) of the right eye.

No definite data are available regarding the food value of these forms but according to the general belief in Kashmir they are regarded as highly fatty; their local names *teth-garh* or 'bitter fish' and *tel-garh* or 'oil fish' are to a certain extent indicative of their food value. Another factor that may have caused this mortality is the low temperature. According to Gaschoot (1929), low water temperature is very favourable to the outbreak of the fatty degeneration of the liver. The specimens under report were received in November when the hatchery water is very cold. According to Davis, the disease is confined to Rainbows only.

Malstripping.—The specimen of Brown Trout, 220 mm. in standard length is a 2-year old female. An external examination showed the presence of a large number of white patches on the body. A prominent feature was the presence of an ovum at the mouth of the genital opening held in position by a cup shaped sheath protruding out from the genital aperture (Plate I, fig. 2). The posterior half of the left pectoral fin was missing, and almost all the other fins were considerably frayed (Plate I, fig. 1).

Internally the ovaries were found to be fully developed and contained mature ova still held intact in the ovarian follicles. The ovarian membrane was slightly injured a little above the position of the vent and so was also the peritoneum.

From the above it would appear that an effort had been made to extrude the eggs forcibly before they had become loose and fallen into the body cavity; this operation seems to have resulted in the extrusion of only one egg, inflicting at the same time injuries to the ovarian membrane and the peritoneum. Similar cases of malstripping have been noticed by me (in press) from the Hatcheries of the Kagan Valley, Hazara District. The white patches noticed on the skin may be due to a fungus attack, but a microscopic examination of scraping from these regions did not reveal any parasitic infection. The missing portion of the left pectoral fin seems to have been nibbled off by a stronger trout. Frayed condition of the fins, especially of the caudal (Plate I, fig. 2), is clearly noticeable. According to Rushton (1937, p. 358), the fins become frayed when the fish are kept under insanitary conditions.

SUMMARY.

From an examination of the material in the collection of the Zoological Survey of India the author discusses an epidemic that broke out among Rainbow Trout in the Harwan Hatchery, Kashmir, in 1934. He further makes observations on certain recent cases of mortality from the material obtained from the same hatchery in 1938. A short description of the material and the results of the *post mortem* examination are given.

The epidemic is traced to lipoid or fatty degeneration of liver, which was probably caused through feeding the fish on fatty diet. Normally the disease would have never occurred in the form of an epidemic but it was accentuated owing to unfavourable conditions that prevailed for several months preceding the epidemic. These were—shortage of water, insanitary conditions of the pens and over-crowding that resulted in abrasions, and subsequent attack by fungus. The malady was further aggravated by the breeding season when the vitality of the fish is naturally reduced as the epidemic was noticed just at the close of the breeding season.

The recent cases of Rainbow mortality corroborate the observations made in connection with the fatty degeneration of the liver in the cases of mortality of 1934. In the case of Brown Trout death has been attributed to malstripping, while the frayed condition of the fins was probably due to unhygienic conditions of the pens.

NOTE ON THE 1934 EPIDEMIC AMONG RAINBOW TROUT IN THE HARWAN HATCHERY, KASHMIR, BY BRIGADIER A. CAMPBELL ROSS.

1. The Hatchery was inspected by the Game Warden (Major Anchal Singh) on the 1st April, 1934 when everything was correct and as far as we know no signs of disease.

2. From 1st to 15th April . . . 13 'Rainbow' had succumbed; on 16th four were sick, on the 17th two fresh cases developed; and all six of these died on the 17th and 18th April making a total of 19 casualties from 1st to 18th April.

3. Total stock of Rainbow in all Pens in the Hatchery is as follows:—

85 Cock fish.
25 Hen fish.

130 total. (These fish are all of over 2 years; excluding yearlings and younger fish.)

4. The death among the 'Rainbow' according to age and sex are as follows:—

No.	*Date of death.*	*No. of tank.*
2 Cocks	3–4–1934	5
1 Cock	5–4–1934	5
2 Cocks	5–4–1934	4
1 Hen	5–4–1934	5
2 Cocks	6–4–1934	4
1 Hen	8–4–1934	4
1 Cock and 1 Hen	9–4–1934	5
1 Cock	10–4–1934	4
1 Hen	13–4–1934	5
2 Cocks	17–4–1934	5
2 Hens	17–4–1934	4
1 Cock	18–4–1934	4
1 Hen	18–4–1934	5

		Weight.	*Approximate age.*
Cocks	2.	5 lbs	5–6 years.
	4.	4 lbs	3–4 years.
	1.	3½ lbs	3–4 years.
	4.	3 lbs	3 years.
	1.	2½ lbs	3 years.
Hens	1.	4½ lbs	4–5 years.
	1.	4¼ lbs	4–5 years.
	1.	4 lbs	3–4 years.
	1.	3½ lbs	3–4 years.
	1.	3 lbs	3 years.
	2.	2½ lbs	3 years.

5. The proportion to sex among the casualties is:—

12 Cocks to 7 Hens.

The disease appears to attack the older fish as nearly all the yearlings and 2-year olds so far appear to be immune.

Description of Disease.

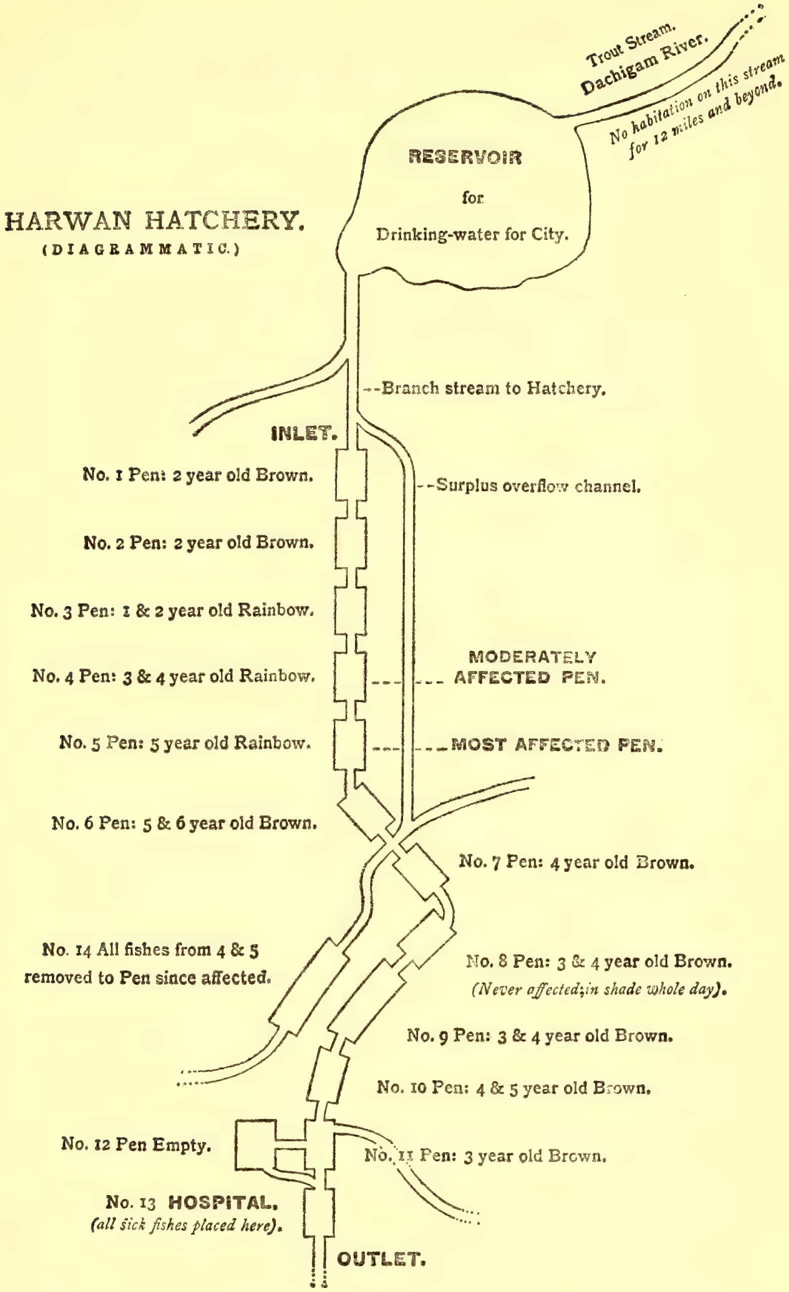
Taken from a Hen 'Rainbow' fish (age 3 years and weight 3 lbs.) when sick for five days. She died on the 7th day.

(*a*) Very bulging eyes covered by a white opaque film, like very severe cataract. This is the principal feature of the disease—the eyes at first protrude right out of the socket; then get covered by the opaque film after which the eye subsides to normal.
(*b*) Edges of fins ragged and discoloured. Edges turned white.
(*c*) Large white marks below the gills.
(*d*) Mucous membrane inside the mouth white and very anæmic.
(*e*) Stomach discoloured and whole body turning blackish.

Other data.

Water.—

(*a*) *Source.* There is no change in the source of water supply, which has been the same since the establishment of the Hatchery over 30 years ago; the channel of the water course being the same,


HARWAN HATCHERY.
(DIAGRAMMATIC.)
Trout Stream.
Dachigam River.
No habitation on this stream for 12 miles and beyond.
RESERVOIR for Drinking-water for City.
--Branch stream to Hatchery.
INLET.
No. 1 Pen: 2 year old Brown.
--Surplus overflow channel.
No. 2 Pen: 2 year old Brown.
No. 3 Pen: 1 & 2 year old Rainbow.
No. 4 Pen: 3 & 4 year old Rainbow.
MODERATELY AFFECTED PEN.
No. 5 Pen: 5 year old Rainbow.
MOST AFFECTED PEN.
No. 6 Pen: 5 & 6 year old Brown.
No. 7 Pen: 4 year old Brown.
No. 14 All fishes from 4 & 5 removed to Pen since affected.
No. 8 Pen: 3 & 4 year old Brown.
(Never affected; in shade whole day).
No. 9 Pen: 3 & 4 year old Brown.
No. 10 Pen: 4 & 5 year old Brown.
No. 12 Pen Empty.
No. 11 Pen: 3 year old Brown.
No. 13 HOSPITAL.
(all sick fishes placed here).
OUTLET.

A rough plan of the Harwan Hatchery.

(Supplied by Brigadier A. Campbell Ross.)

(*b*) *Temperature.* Temperature was taken in the Pens 7 times a day. The variation was from 50½° at 7.25 a.m. to 54° at 1.25 p.m. (Chart given below).

Food.—Fresh country fish supplied under contract (a maund daily at 12 noon), fed twice during the day about 7. a.m. and 7 p.m. Source of supply exactly the same as it has always been. Nothing apparently wrong with the fish given as food.

Cleaning of Pens.—Pens are cleaned out once annually in mid-winter. Bottom of Pens natural earth which silts up to 3 to 6 inches during the year.

Climatic.—The winter was unusually open and mild and the supply of water at one period fell very low. During the past winter the fall was normal, *i.e.* 2/3 of summer supply.

One curious feature of disease is that though 'Brown' Trout of about the same age are in the same Hatchery they did not seem to have been affected. The proportion of deaths among 'Rainbow' according to sexes is as follows :—

12 per cent among the Cocks and 5 per cent among the Hens. So it would appear to attack the Cock fish more virulently than the Hens.

A rough plan of the Hatchery is attached (text-fig. 2). The greater portion of death occurred in Pens 4 and 5, but it must be remembered that these are the Pens which contain all the *big* 'Rainbow'.

Temperature of Tanks on the 16th April 1934 in the Harwan Trout Hatchery

Time	*Tank*	*Temperature*
7-25 a.m.	No. 1	50½°
	No. 4	50½°
	No. 5	50½°
	No. 8	50½°
9-25 a.m.	No. 1	51½°
	No. 4	51½°
	No. 5	51½°
	No. 8	51½°
11-25 a.m.	No. 1	52½°
	No. 4	52½°
	No. 5	52½°
	No. 8	52½°
1-25 p.m.	No. 1	53°
	No. 4	54°
	No. 5	54°
	No. 8	53½°
3-25 p.m.	No. 1	52½°
	No. 4	53°
	No. 5	53°
	No. 8	53½°
5-25 p.m.	No. 1	51°
	No. 4	51½°
	No. 5	51½°
	No. 8	52°
7-25 p.m.	No. 1	51°
	No. 4	51°
	No. 5	51°
	No. 8	51°

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EXPLANATION OF PLATE.

Fig. 1.—Lateral view of a Brown Trout from the Harwan Hatchery showing white patches on the body and frayed caudal fin.

Fig. 2.—Same as above, dissected to show

a. Extruded ovum at the mouth of the genital aperture; *b*. Injury to the ovarian membrane; and *c*. Injury to the peritoneum.

Fig. 3.—Lateral view of a male Rainbow Trout that died during the epidemic of 1934. Areas enclosed by white rings indicate portions of the skin attacked by the fungus *Saprolegnia*.

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[1] Not seen by the author.

OBITUARY.

MAJOR-GENERAL SIR H. C. TYTLER, K.C.B., C.M.G., C.I.E., D.S.O.

As briefly announced in this *Journal* on p. 235 Major-General Tytler died at his home at Ross-on-Wye on May 16th at the age of 71. Sir Harry entered the Indian Army in 1887, and at the early age of twenty-one, took part in the Sikkim Expedition and was mentioned in dispatches. In the Lushai Expedition of 1890-1891, he commanded the small force which relieved Changsil. Ten years later he was in the Waziristan Expedition.

During the Great War he was Deputy Inspector-General of the lines of Communication, and later Column Commander. He was twice mentioned in dispatches. In 1918-1919 he was Inspector of Communications in Persia, and held similar appointments in the Third Afghan War and with the Waziristan Field Force of 1919-1920. He afterwards commanded the Delhi Brigade Area, and from 1921 to 1924 he was D.A. and Q.M.G. Northern Command. His last four years of active service were spent in the Command of the Burma District.

Sir Harry was an enthusiastic collector of butterflies; he was also much interested in ornithology, and formed a good collection of the eggs of Indian birds. It was, however, to the study of butterflies that he devoted most of his spare time. He amassed one of the finest collections ever made in India, for he had unrivalled opportunities for procuring specimens during the years spent in Assam, Burma, and the North-west. He communicated to this *Journal* the results of his studies, adding largely to our knowledge of Indian butterflies, especially of those found in Assam, many new species and forms being described, and important observations made on many others till then hardly known.

His first contribution to this *Journal* was entitled 'Notes on Butterflies from the Naga Hills', and appeared in 1911-1912 in vol. xxi. Then followed 'Notes on Some New and Interesting Butterflies from Manipur and the Naga Hills', published in 1914-1915, vols. xxiii-xxiv. In 1926 appeared his 'Notes on some new and interesting butterflies from India and Burma', vol. xxxi.

During 1938, Sir Harry had almost completed a fourth extensive paper, the preparation of which had been much interrupted by serious illness. The first part of this paper was sent by him to the printers just before his last illness, and is published in this Number. Arrangements have been made for publishing the second part in due course.

Sir Harry presented to the British Museum (Natural History) paratypes of many of the forms described by him, and also specimens of many rarities.

G. T.

REVIEW.

I.—FAUNA OF BRITISH INDIA. Butterflies. Vol. I. (Second edition). Talbot. Published by Taylor and Francis, Ltd., London on the 8th March, 1939. $9\frac{1}{4} \times 6\frac{1}{8}$: xxix+600 pages : 3 coloured plates and 184 text-figures ; map of the Indian Empire and Ceylon. Price 35 shillings.

Mr. G. Talbot, the author, is a newcomer to Indian collectors and requires an introduction. He is aged 56 and has spent his life as a professional 'Rhopalocerist', starting as Assistant Curator to the late Mr. H. J. Adams and then becoming Curator to the late Mr. J. J. Joicey, who was the owner of one of the largest private collections. Mr. Talbot is now an unofficial assistant in the British Museum. His knowledge of the world's butterflies is unrivalled and he has written many important papers and books, while he is regarded as the leading expert on the *Pieridae.* It will be seen that the General Editor of the Fauna could not have secured the services of anyone more competent for writing the Butterfly volumes than Mr. Talbot.

The work has been largely compiled in the British Museum, which now possesses by far the most important collection of butterflies in the world, having had added to it during recent years the Rothschild, Joicey, Oberthur, and Frühstorfer collections.

The first volume of the second edition deals only with the *Papilionidae* and *Pieridae,* which with half the Lycaenidae comprised the second volume of the first edition. It will be seen that the space taken up by the subject matter is now doubled. The volume commences with an excellent glossary, more complete than provided hitherto in any book on butterflies. The introduction is most comprehensive and up-to-date : it is arranged in 9 sections, viz. :—

1. History of the study of Indian butterflies.
2. Life history.
3. External morphology : with excellent accounts of the androconia or scent scales and the genitalia, the study of which have proved of the greatest importance.
4. Classification.
5. Ecology : with a full account of scent organs and habits.
6. Protective resemblance and mimicry.
7. Variation.
8. Distribution.
9. Collecting and preserving.

The body of the work with its keys and descriptions of species etc. follows the form of the first edition, but a great deal more information has been included regarding the early stages and the genitalia. A small increase will be noticed in the known species, while the numbers of local forms have increased vastly. The volume ends with a complete Bibliography and there are the usual systematic and alphabetical indices.

Collectors will, it is feared, notice a great many changes in names familiar to them, such as *Polydorus* for *Tros, Cepora* for *Huphina, Anaphasis aurota* for *Belenois mesentina*, *Graphium* for *Pathysa*, *Eurema* for *Terias, mahagura* for *zaneka.* The changes are necessary to accord with the International rules of nomenclature and there is no doubt that stability in this respect is being reached.

The work has been carefully and conscientiously compiled, a very high standard having been reached, which it is hoped will be maintained in the future volumes. Such criticisms as can be made, may be taken as representing one's personal predilections rather than in depreciation of what is a most important contribution to science.

The Phylogenetic scheme postulates the *Hesperiidae* having a common ancestor with the other families of butterflies : there is no evidence to support such a presumption. The question is touched upon very lightly on page 22.

The division of families into sub-families and tribes is of doubtful scientific value : subgenera have fortunately been avoided.

The order of arrangement followed in the keys differs from that adopted in the text. To preserve the natural order in the key is sometimes difficult, but in cases such as the first key on page 60 a correct arrangement would have been quite simple. In reading through the second key on the same page, the question arises as to why the *Graphiini* in the text have to be placed between the *Papilionini* and *Teinopalpini*.

The reduction in the number of coloured plates on financial grounds is unfortunate, but is more or less balanced by the increase in the number of text-figures, of which even more would have been acceptable. The colours in plate II are somewhat alarming.

The map should be brought up to date in future volumes. Burma is no longer a part of the Indian Empire. The red lines indicating presumably Indian states are very confusing and probably inaccurate as one of the largest, viz. Kalat, has been omitted.

W. H. Evans.

II.—UGANDA GAME DEPARTMENT. Annual Report for the year 1938.

There is little difference between the Annual Report of the Uganda Game Department for 1938 and that for 1937, except that the statistics of revenue from wild-life resources is not so favourable for the year 1938.

Expenditure remains much the same, being £6,365 against £6,554 in 1937 ; but although there is a falling off in revenue of about £8,672 there is still a handsome profit of over £5,000.

This decrease in revenue is due to :—

(*a*) Reduced price of ivory.
(*b*) Fewer game and special licences issued.
(*c*) Fewer elephants killed under 'control'.
(*d*) Decrease of 36% in amount of government ivory disposed of by auction.

Under Section I.—Administration. We read in paragraph 4, 'Owing to the low price of ivory elephant hunting has declined in popularity.' In the same section, paragraph 13, we read :—'Elephant hunting for ivory, continues to be a fairly popular pastime.' It seems to cut both ways in Uganda !

Game Reserves and Sanctuaries.

No information of the slightest value is given under this heading except the fact that about 90 square miles of the Bunyoro portion of the Bunyoro and Gulu Reserve which was excised in 1935, has been re-incorporated.

One hundred and fifty words serve to dispose of this chapter—there are 56 pages in the report—and one looks in vain in other parts of the publication for information on what should be the most important activity of a Game Department ; the administration and consolidation of Game Reserves and Sanctuaries.

Game Trophies.

We have, as in the 1937 Report, long lists of weights of tusks from elephants killed by licence holders, and again in Section II. Elephant Control, long lists of the numbers of elephants killed by the control organization as well as details of the weight of the tusks. Twenty-six African 'control' guards were employed, the same number as in 1937.

It is interesting to note that of 1053 elephants destroyed under 'control 745 were males and 308 females. From this number there were collected

2,069 tusks of which no less than 1,110 weighed under ten pounds each, three weighed over sixty pounds each, one over seventy pounds and one over eighty pounds. Also 181 tusks were 'found' from the Control Area of which sixty-four were under ten pounds each, three were over sixty pounds, two over seventy pounds, and three over eighty pounds.

Up to 1937 the toll of killings under 'control' had steadily gone up; in 1937 it started to decrease which was reported to be due to shortage of staff. In 1938 there was a decrease of about 30 per cent from the 1937 figure. The bag is getting less.

It is a fair deduction to make that the numbers of elephants are decreasing too, because the price of ivory can scarcely affect these activities. This is, I suppose, the ultimate object of 'control'? In paragraph 21 we read as follows :—

21. 'Elephants generally are as abundant as ever. The influence of effective control in most localities is reflected in the very marked decrease in total wastage, five hundred fewer elephants being destroyed this year. The estimated total wastage is 1,500.'

If the elephants are as abundant as ever should we understand from this statement that 'control' is keeping the elephants that are still there away from the controlled area because they realize the danger? I wonder? That is I believe the theory, but is it a reality?

In the detailed accounts of elephant control in the Provinces we are told of less damage to crops which shows that in these places, whatever the reason, 'control' is achieving its object.

In this section under heading GENERAL we find some amusing stories of what elephants have done, or can do, or are reported to have done.

In SECTION III.—NOTES ON THE FAUNA, we find as in the 1937 Report that the misdeeds of the Fauna are related in some detail and at considerable length.

In paragraph 117 reference is made to the White Rhinoceros which is supposed to be increasing. This is good news and it is to be hoped that reliable reports will be recorded.

The observations on birds are intensely interesting and instructive.

Under (*c*) Reptiles, in this section, one reads in paragraph 143 to paragraph 146 of the intensive killing of crocodiles. Crocodiles, as a species, no doubt have their uses, and when it appears that an attempt is being made to exterminate the species in some particular place, as the actions described seem to indicate, it would be interesting to know on what evidence such acts are based. We would like to hear both sides of the case, not merely the bare fact of destruction. We are given no reasons.

Under SECTION IV.—GENERAL, there are many items of interest. Under paragraph 154 the Game Warden records that he finds the varied demands of Publicity are an increasingly heavy burden. But I would point out that there is little publicity given in this report to the practical work of conservation. Perhaps there is not any?

In paragraph 159 we find a criticism made by a speaker at the London University of what is going on in our African Colonies detrimental to our wildlife.

However inaccurate these criticisms may be, reports such as the one under review lead up to such expressions of disapprobation.

Under SECTION V.—FISHERIES, The economic position of the Uganda Fisheries is set out in considerable detail. The statistics given are no doubt extremely interesting from a financial point of view.

The sporting side of fishing is referred to under (B) Angling. We are told that rainbow trout fishing in the Sebei country on Mt. Elgon will be opened this year (1939).

Generally speaking this is a disappointing report, supplying little if any information on the conservation and preservation of the fauna of Uganda, but emphasizing the activities of the Game Department as a revenue producing department.

THEODORE HUBBACK.

August 1939.

III.—FAUNA OF BRITISH INDIA. 'Mammalia'. Vol. i. Primates and Carnivora (part ?), (Second edition), by R. I. Pocock, F.R.S. Pp. xxxiii+463, with 31 plates and 106 text-figures. Taylor & Francis, Ltd., March 31st, 1939. Price 30 shillings.

It is just over 50 years since the first edition of the 'Mammalia' appeared, under the aegis of the Fauna of British India series. In the first part of that work, which contained the Orders Primates, Carnivora and Insectivora, Dr. W. T. Blanford, the author, enumerated and described 27 species of Primates, 73 species of Carnivora and 31 of Insectivora, resident within the confines of British India, Burma and Ceylon.

At the time that this work was published, namely in 1888, and for many years afterwards, sub-species or 'constant geographical varieties' were not, of course, recognised as such. Scientific research had not then advanced sufficiently far to realise the significance of the presence of these constant varieties, due to climatic or geographical isolation, that differ to a greater or a lesser degree from the typical, yet are not sufficiently marked to admit of recognition as good species. In a number of cases, Blanford admitted as distinct species, forms that are now considered as nothing more than well marked races or sub-species, while others, less well marked, he ignored entirely or referred to them merely as 'varieties'.

In the new edition, Professor Pocock has recognised and described these sub-species, which are so numerous amongst our Indo-Ceylon mammalian species, and he has therefore, of course, adopted the trinomial system of modern nomenclature. Professor Pocock recognises, in this first volume of his new edition, 73 distinct forms (20 species) amongst Primates and 77 forms (30 species) amongst the Carnivora to the end of the sub-family Hemigalinae (the Banded Palm-civet) which concludes the first part of his work.

Before it became possible, even to consider the commencement of the systematic work, which had to be done prior to the writing of the present edition, it was necessary to gather together extensive collections of specimens from all parts of the area to be included within the scope of the work. It was here that the Bombay Natural History Society was able to render such invaluable assistance.

As long ago as the year 1911, the Society launched its admirable 'Mammal Survey of India' which, although interrupted by the World War and resumed subsequently on a somewhat smaller scale, made collections of the utmost value from almost all the more important climatic zones and areas within British India, Burma and Ceylon. These collections were supplemented by others, made by private collectors, with the help or through the encouragement of the Society, and all were sent to the British Museum for examination and determination. Without the generous assistance of the Society and its supporters, the collection of this essential material would have been well-nigh impossible.

It has taken many long years of hard work to examine, measure and classify the vast amount of material collected, to compare it with the types of the forms already described and to determine the status, relationship and distribution of each specimen. The work of classification and comparison and the researches into the nomenclature were begun by Messrs. Oldfield, Thomas and Wroughton, about the year 1917, and has been carried on since by various other workers until it was taken over and brought towards completion by Professor Pocock.

A colossal amount of research work forms therefore, the base upon which the new edition rests. Just as the first edition has been looked upon as the standard work on Indian Mammals for the past fifty years, so the present volume will be accepted, in its place, as the standard work for very many years to come.

Professor Pocock has done his work in an extremely able manner. In the new edition, he has retained the general form of the old edition but he has revised and brought up to date all the letterpress. After his introduction, which deals chiefly with the Geographical Distribution of the Mammals of British India, he goes on to give, in general outline, a description of the Class *Mammalia*. He then gives a short but adequate description of each

Order, Sub-order, Section, Family, Sub-family, Genus, Species and Sub-species, in its proper systematic order.

In writing a volume such as the new Mammalia, the difficulty is always to know what to leave out, in order to conserve space, and in this Professor Pocock has shown excellent discretion. His descriptions are concise and easy to follow and, in the short space available, he gives a vast amount of interesting detail and essential information.

The pages are well illustrated with numerous text-figures, showing skulls, heads and other important points in the anatomy of the subject that he is describing. There are also 31 plates, of which 14 are photographs of living animals. At the end of the volume there is a very useful map, showing the whole area included within the scope of the work.

In studying this volume, one is at once struck by the enormous amount of work that has, quite obviously, been put into its compilation and the care with which all the facts have been assembled and presented. It is a work that reflects the greatest credit upon the Author and will remain, for many a long day, a fitting monument to his industry and to his deep knowledge of Indian mammals.

As a guide to Indian mammalian fauna, it is without equal and it is just as interesting and valuable to the systematic scientist and the field naturalist, as to the Sportsman who takes an intelligent interest in the wild life of the jungles that he visits. It is a book that is essential to every one over whom the jungles and their wild life have cast their fascination.

W. W. A. P.

IV.—TREES AND SHRUBS IN MY GARDEN. By T. H. G. Stevens. Pp. 335 with 12 coloured plates and 32 plates in half-tone. London: George G. Harrap & Co.; 1939. Price *12s. 6d.*

The author is an amateur and writes for other amateurs to help them to avoid the mistakes he has made and to enable them to obtain the best results in planting, pruning, and manuring the various types of soil. The book is not only reliable but also readable, for Mr. Stevens combines the qualities of the teacher and the artist. Forty-four excellent plates testify to the success of the author as a gardener.

The opening chapter, entitled 'Getting Ready', is replete with sound advice which, if followed, must blossom into a garden full of beauty. Mr. Stevens first recommends the planting of six trees, a dozen roses, a dozen deciduous shrubs, and a dozen evergreens; he then suggests a further selection and, by repeating the process from chapter to chapter, finally meets the requirements of the small gardener and of his more fortunate confreres. In every case the ultimate height of the plant, the characteristics of its foliage and flowers, and its reaction to the soil are carefully noted.

An important feature of the book is the section giving lists for quick reference of trees and shrubs classified according to their height and showing at a glance whether they are conifer, deciduous, or evergreen; the approximate time of blooming; pruning seasons; trees and shrubs for hedges; climbers; trees and shrubs for towns; Latin and English names; the best roses; weeping trees.

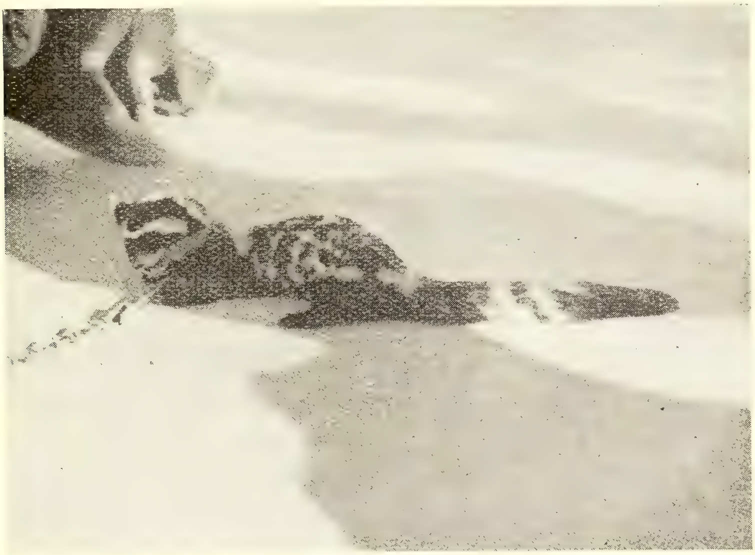
In the last chapter, entitled 'My Confession', Mr. Stevens writes: 'I commenced to write this manuscript during long winter evenings, thinking it would be reproduced cheaply as a pamphlet and circulated amongst my friends and acquaintances. The task became a pleasure and ruthless abridgment became impossible. The lists I had intended to cut down so as only to include a few of the very best shrubs could not be shortened without leaving out favourites which just couldn't be left out. Forgive me if I have been long-winded . . . ' The author need not worry; we not only forgive him, but feel like asking him for more. Why not?

J. F. C.

MISCELLANEOUS NOTES

I.—THE BREEDING OF THE MOTTLED POLECAT (*PUTORIUS SARMATICUS*).

About 21st March a Mottled Polecat was seen on a bank between an orchard and a cornfield just outside Quetta. This bank was riddled with coney holes. About middle of May a young one was seen probably 5-6 weeks old and a watch was kept until a fortnight later the nest was dug out and the litter of 3 taken. They must then have been about 2 months old and the photo shows one at that time.



Mottled Polecat.
(*Putorius sarmaticus*)

It was very vicious and ran up an officer's clothes and bit him in the head! It bit several other people and was put in a large wire-netted run with corrugated iron sunk 3 feet into the ground. It burrowed at once and ate raw meat only at night. In 3 nights it had burrowed under the corrugated sheeting and made its escape. At no time did it emit any odour after the fashion of polecats, and local people informed me it did not do so until after it was a year old.

A. F. P. CHRISTISON,
Brigadier.

H. Q. 4TH (QUETTA) INFANTRY BRIGADE,
QUETTA. *July* 3, 1939.

II.—THE MOTTLED POLECAT (*PUTORIUS SARMATICUS*).

Extension of known range.

I am writing to inform you that today a specimen of the Mottled Polecat (*Putorius sarmaticus*) was brought in to me by one of the local villagers. Blanford's *Fauna of British India* refers to this animal as being very rare except in South Afghanistan about Kandahar and Quetta where it is common. Its occurrence in the Kohat District of the N.-W.F.P. I thought would interest you.

J. O. S. DONALD,

HANGU,
N.-W.F.P.
August 22, 1939.

Captain.

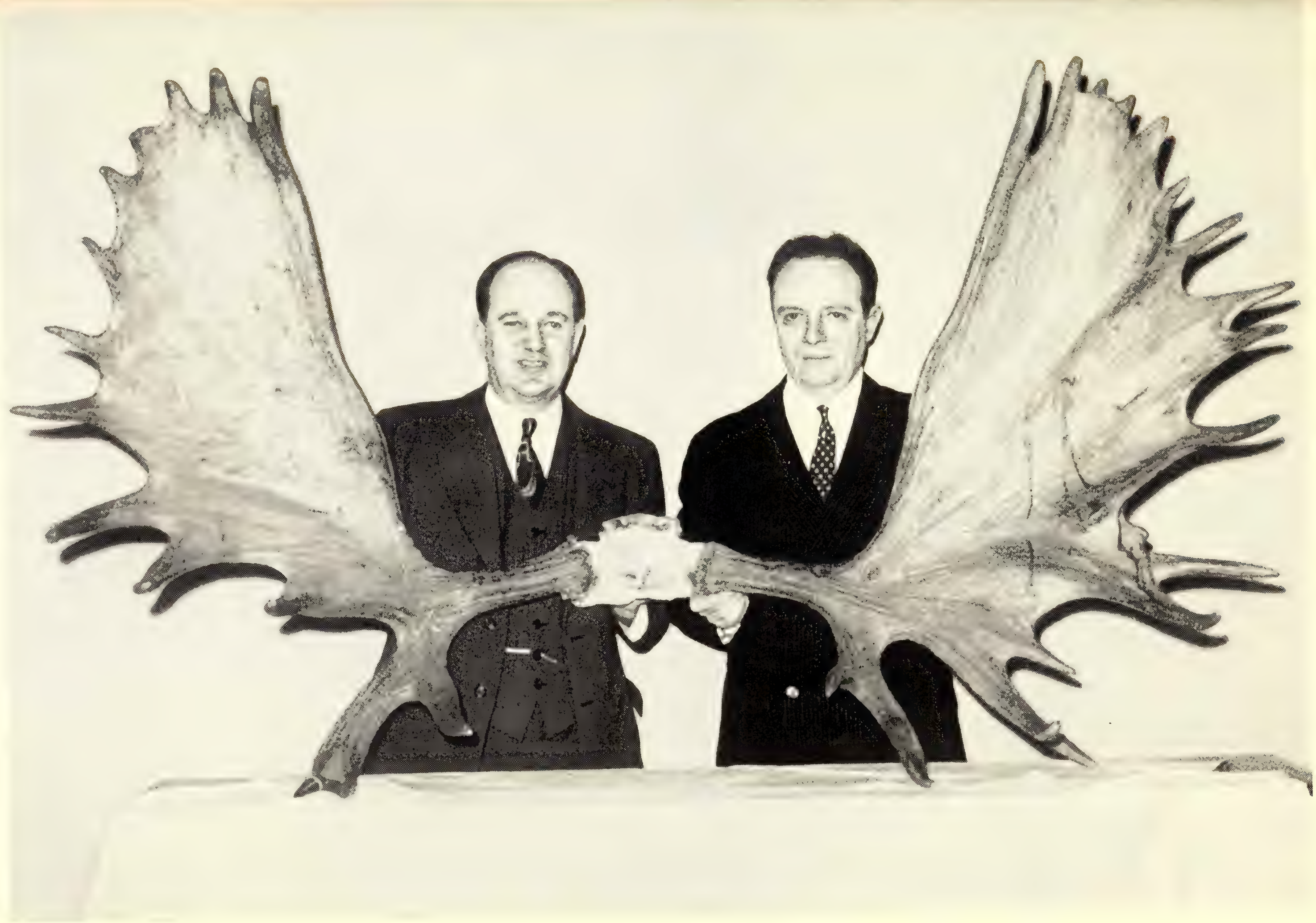
[The Mottled Polecat is described as being common about Quetta. An excellent account of the animal is given by Hutton (*J. A. S. B.*, xiv, p. 346). 'It lives in the ground in burrows (probably made by rats originally), and appears to be equally common in cultivation and in uncultivated tracts. It is chiefly nocturnal, but is occasionally seen abroad hunting in the daytime. It feeds on birds, rats, mice, lizards, beetles, and snails, and probably, like the common polecat, on any animals that it can master, and is excessively sanguinary. A caged animal kept by Hutton killed in succession 4 wagtails and 4 rats, two of the latter full-grown and large. The rats were always seized in the same place, just behind the ear, held until they ceased to struggle, and then killed by one or two bites through the back of the skull. As the blood flowed from the wounds, the polecat lapped it up, but never attempted to suck it. Although the animal that slaughtered all these birds and rats had been fasting for some time, it made no attempt to eat its victims during the day, but stored the bodies in a portion of its cage divided off as a sleeping apartment, and only fed after nightfall. The whole account given (l.c.) is too long to copy, but is worth reading. The young are produced in holes about the end of March or beginning of April and are usually three or four in number. This species has the same disagreeable foetid odour that is characteristic of the common polecat.'—EDS.]

III.—THE RECORD ALASKAN MOOSE

(*ALCES A. GIGAS*).

(*With a plate*).

I am enclosing a photo of a moose-head claimed to be the World's record and a copy of a letter I have received with the same, in case you would like to reproduce the photo in the *Journal*. The animal was shot in Alaska by Mr. Wilton Lloyd Smith during his Alaska Expedition in 1938. Mr. Lloyd Smith's Secretary in sending the photo gives the following details:—The spread is 77-5/8″. It was measured green in Alaska in October at 78-3/4. The previous world's record was 76-1/2″



The Record Alaskan Moose.
(*Alces alces gigas*).

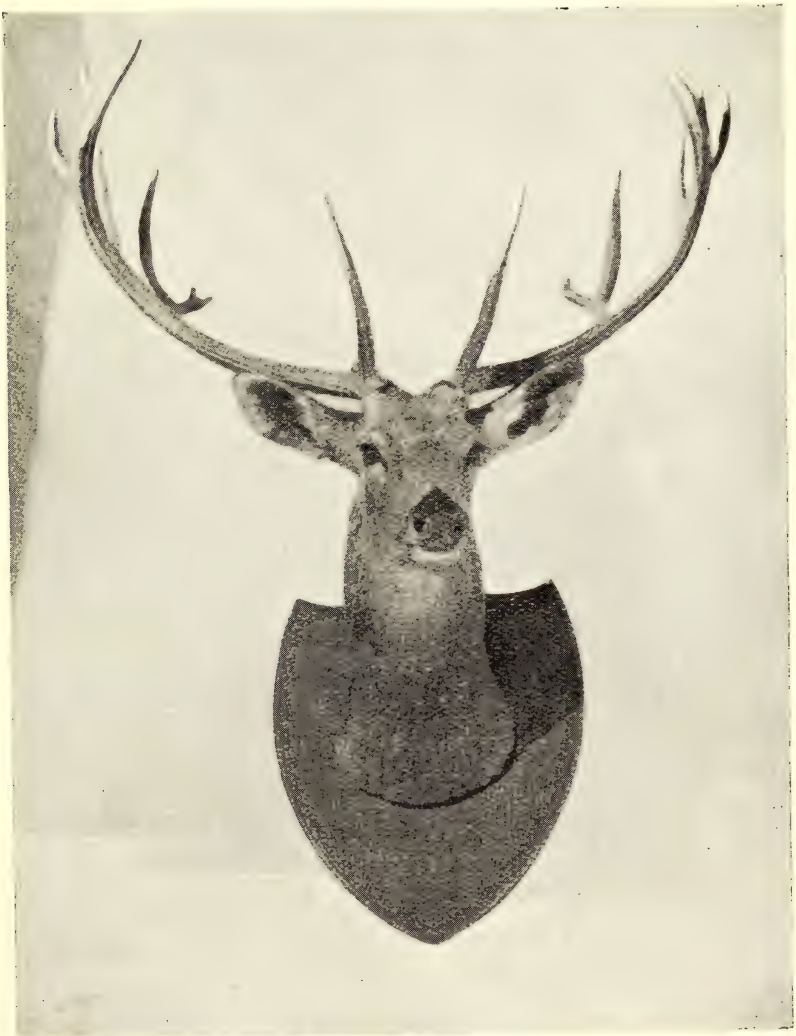
and has stood since 1901. This head is in the Field Museum in Chicago. This head will be part of the new moose group in the American Museum of Natural History.

R. C. MORRIS.

HONNAMETTI ESTATE,
ATTIKAN-MYSORE P. O.,
S. INDIA,
February 8, 1939.

[Though the Moose does not occur within our area, we publish the photo as being of general interest to hunters of big game.—EDS.]

IV.—A FINE SWAMP DEER HEAD.



Swamp Deer (*Cervus duvauceli*).

I am sending a photograph of a fine head of the above deer that I was lucky enough to bag some time ago. The mounting is by Van Ingen of Mysore and is absolutely lifelike.

The head is a 16-pointer :—

Length :—Left horn : $38\frac{1}{4}$ in. Right horn : $8\frac{3}{4}$ in.
Girth :—Above the Brow Tine : $5\frac{1}{2}$ in. Points 8 × 8.

This stag was bagged in the North Kheri Forest Division of the U. P. solely due to the kindness of the Forest Officer, who arranged the loan of an elephant for me from a local Talukadar. I may state that shooting *Gond,* as these stags are called in those parts, is impossible without an elephant, unless the grass is burnt.

As a concrete example of Game Preservation the area in question is hard to beat; between the Forest Block, and shooting Reserves of two nearby landowners, including the gentleman who lent me one of his elephants, I should estimate that there are over 500 head of this deer, if not more. At the time of my visit in November, the stags were 'roaring' in the high grass, and the shooting difficult; but I was told by the local Forest Guard and others that there were at least 2,000 Swamp Deer in that area; this is probably an exaggerated figure. It must be a sight for the Gods to see these deer in herds when the grass is burnt. Besides *Gond,* I saw any number of Spotted- and Hog-Deer, but few Sambhur. Actually the type of terrain which is mostly flat grassy plain and swamp, is unsuited to the latter; but no doubt they are plenty in the nearby heavy forests of the Reserve.

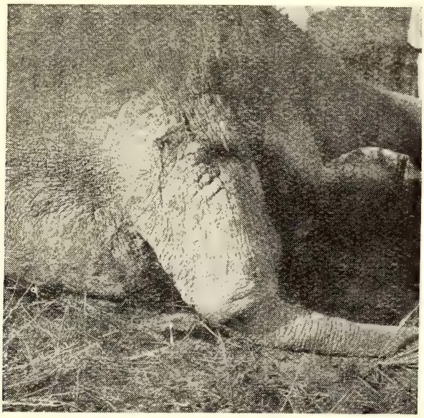
In drawing the attention of the U. P. Forest Department to this area, I would remind them that the Swamp-Deer is the most easily exterminated of our Indian deer; though I consider, the handsomest. The U.P. and Assam have had the sad experience of finding this deer exterminated outside of Forest Reserves and Sanctuaries by meat hunters and poachers, including so-called shikaris. The type of terrain favoured is also much in demand by cattle and buffalo graziers, as well as cultivators. Can not a closed Sanctuary be formed of part of this area, especially for Swamp-Deer; which I do not think are found in the Hailey National Park?

J. E. HALL.

GAYA.
August 14, 1939.

V.—CURIOUS INJURY TO THE TAIL OF AN ELEPHANT.

I enclose two photos of a large growth, or swelling at the base of the tail of a *mackhana* shot near here recently. The growth was about two feet long by one foot in diameter, and considerably lacerated on the upper portion, this latter condition brought about, no doubt, by the elephant rubbing against trees in his efforts to alleviate the pain. Pus was issuing from an orifice and dribbling down the animal's hind quarters, as may be seen from the dark patch in one of the photos.



Injury to tail of Elephant.

I had this growth opened up in an endeavour to establish the cause of the injury, but nothing was found, though I must state that the examination was of a rather cursory nature. The interior was a mass of inflamed tissue and pus. There was no indication of a bullet having entered, but this could hardly be expected as the injury was so obviously of long standing, that the small hole made on entry would have completely healed, leaving no trace. There was an old bullet wound just behind the off shoulder, which was also in a suppurating condition.

This elephant was solitary and had been in the habit of raiding crops for some considerable time. He was an old animal measuring about 9 ft. 8 in., and both tushes were broken off short at the gum.

A. J. YANDLE.

Tinkong T.E. & P.O.
Lakhimpur District,
Assam.
May 26, 1939.

VI.—ON THE OCCURRENCE OF HUME'S WEDGE-BILLED WREN (*SPHENOCICHLA HUMEI* MAND.) IN THE AKA HILLS, ASSAM.

I recently obtained and sent to Mr. H. Whistler in England a specimen of *Sphenocichla humei* ♀.

Mr. Whistler, who identified the bird, informed me that this was the first specimen recorded for some 70-80 years, in fact, since a collection was made in Sikkim, by Randell's collectors. The recording of this specimen might be of interest to you. The specimen was obtained at a height of 4,000 ft. on 16-12-'38, in the Aka Hills in the unadministered area of the Balifera Frontier Tract.

G. S. LIGHTFOOT.

Charduar,
Lokra P. O.,
Darrang,
Assam.
June 13, 1939.

VII.—THE SPUR-WINGED PLOVER (*HOPLOPTERUS VENTRALIS* [Wagl.]).

(*A Correction*).

While on a recent journey in Northern Burma, I came across by chance in a rest-house an odd number of Volume xxxii No. 1 of the *Journal* for 1928. I see that in it on pages 219-220 Major R. W. G. Hingston has most adequately forestalled an observation of mine which I thought at the time to be new, and which was described by me in the *Journal* (vol. xxxvii No. 1, p. 223, 1934) under the title 'Nuptial Performance of the Spur-winged Plover (*Hoplopterus ventralis*).'

At the time of writing, I had no idea these curious parade movements in which the body is held quite erect and the birds proceed together with 'slow measured unnatural paces' (to quote Major Hingston) had been described in the *Journal* only a few years before. Major Hingston, it is true, observed the display in September and I in March: but many birds e.g. Rollers, Snipe, Redshanks, occasionally perform under a chance stimulus in autumn what are normally 'mating' displays only visible in spring.

J. K. STANFORD.

Stanton's Farm,
Kingsclere.
June 6, 1939.

VIII.—NOTES ON BIRDS NESTING IN THE KUSHDIL KHAN LAKE, QUETTA.

I returned to Kushdil Khan Lake and the Maleyai reed beds to clear up the question of the grebes, and the reed warblers and little bitterns.

Little Grebe: **Podiceps ruficollis capensis** (Salvad.).

On the 2nd July there were some 60 nests of the Little Grebe on Kushdil. All except one, were of the floating type and all were covered, which is contrary to the experience of Messrs. Williams

(*Journal*, vol. xxxiii, No. 3, 1929 page 613). The other nest was 2 ft. 4 in. over the water in the fork of a tamarisk bush and contained 5 eggs, covered. Eggs measured between 38.6 and 40 mm. × about 24 mm. There were a few pairs of *nigricollis* on the lake but I failed to find a nest.

Reed Warblers: **Acrocephalus stentoreus brunescens** (Jerd.), **A. agricola** (Jerd.).

At the Maleyai reed beds I found 8 of the smaller type of Reed Warblers' nests 3 ft. to 3 ft. 6 in. above water mostly with 3, some with 4 eggs all hard set and birds sitting close. I took the birds to be either *agricola* or *dumetorum.* They were definitely not *brunescens.* Eggs averaged 16·8 × 12·9 mm. Largest 17·2 × 13, smallest 16·4 × 12·8. Major Darcy, R.A., kindly checked these measurements for me. Eggs were stone colour, primary marks dark greyish-olive-brown blotches, with underlying marks of pale indigo-grey. Both markings were abundant at the blunt end, and all eggs had a definite dark greyish-olive-brown ring (a cap in some) at the blunt end. What are they?

The larger type of nest was a 5 in. cup of dead reed stalks lined with reed fibres and 3 ft. to 4 ft. over the water. *A. s. brunescens* were sitting hard. Two nests contained 4 eggs, two 5, and one 6. The ground colour was light stone in some, in others very, very pale greenish-blue. They were blotched and flecked with browns, greys and olive-browns mostly at the blunt end. Largest egg 24.2 × 17 mm., smallest 22.7 × 15.4 mm. average 23.2 × 16 mm.

Little Bittern: **Ixobrychus minutus minutus** (L.).

Three nests found and several birds seen. Is a very local but regular summer visitor to Maleyai reed beds. I found young there on 18th July last year.

Each nest was 2 ft. above water being built up solid, and made of dead reed stalks, unlined. Each had 5 eggs hard set on 2nd July. Eggs were pure white with no gloss and none had the faint bluish tinge fresh eggs sometimes show. Largest egg 32 × 27.5 mm. Smallest 29 × 25.5 mm. Average 30.2 × 26.5 mm. Does this agree with records?

Common Coot: **Fulica atra** (Linn.).

A Common Coot nested on Kushdil this year. I have no previous record for Baluchistan. Have you?

A. F. P. CHRISTISON,
Brigadier.

10 QUEENS ROAD,
QUETTA.
July 30, 1939.

[From the writer's description of the eggs and nest it would appear that the Warblers were probably *Acrocephalus agricola.* The eggs are too small for *A. s. brunescens* of which the average measurement is 22.7 × 15.9, but agree with the measurements of *A. agricola* as given by Baker (*New Fauna*) i.e. 16.8 × 12.9 mm. The colouration also agrees with the Baker's description of the eggs of this species in the *New Fauna*. *A. dumetorum*, which is also described as a passage migrant, is not found breeding over water. In Europe and the Altai where it breeds, it builds a deep cup-shaped nest in bushes and brambles; in the Himalayas it is described as building a ball-shaped nest low down in rose bushes well away from water. The nests of *A. agricola* however are described as 'beautifully made very deep cradles of fine grasses woven round two or more stems of a weed or rushes about 18 inches high above the ground of water'. *A. agricola* is described as a passage migrant in Baluchistan and has not hitherto been recorded as breeding in this area. A second interesting find is *Ixobrychus minutus minutus* described as a passage migrant and not previously recorded breeding in Baluchistan, though recorded breeding in the Himalayas and Sind. The Common Coot—(*F. atra*) is also described as a non-breeding visitant to North Baluchistan and common in Kushdil Khan. The finding of the nests of these two species constitute two new breeding records for Baluchistan; while the reed warbler if identified correctly as *A. agricola* would make a third, but as warblers are very difficult to identify with any certainty in the field, the record must be accepted with reserve until confirmed by actual breeding specimens.—EDS.]

IX.—NOTES ON WILD DUCK AND GEESE IN THE SADIYA FRONTIER TRACT, ASSAM.

The following is a note on some observations regarding duck shooting, and species found in the Sadiya Frontier Tract in Assam, gathered from several seasons experience in the District. It may be of interest in view of the fact that the country is not exactly of the type one associates with duck—dense evergreen rain forest—and that not much has been written about this area. If bags were not large, they were full of interest and one had to employ all one's ingenuity to get any return for the trouble taken.

There are no flighting and no driven birds with shooting from boats or machans. Dotted about the Central and Western portions of the Pasighat Subdivision, to which this note chiefly refers, there are numerous small areas; surrounded by very dense jungle and full of cane brakes and elephant grass, which for some reason have become water logged; possibly due to subsidences as a result of earthquakes, or to rivers and jungle streams changing their courses. The jungle has died out leaving the dead gaunt trunks and stumps of the trees standing thickly in the water which has collected. At the water's edge the elephant grass and cane brakes are almost impenetrable except along deer and wild buffalo or bison tracks. Very few of these water logged areas or jungle 'bhils' fail to hold a pair of the White-winged Wood-Duck—(*Asarcornis scutulata*), now protected, outside Reserved Forest, all the year round by the Assam Government. Within Reserves the period of protection is 1st April to 15th September. The more overgrown and sheltered in dense jungle the pool happens to be, the more likely these birds are to be found. This species is by no means rare throughout the Subdivision; but is commonest in the Central and Western areas and I once stumbled on a herd of eleven together. This species is one of the commonest ducks met with in the areas where they are found and their peculiar whistling call can often be heard where it is impossible to get anywhere near them. A good Miri or Abor guide is absolutely essential and also an elephant, if possible, otherwise one would get lost in no time. The way these men find their way about; when to myself there was no indication of a path and the sky was very rarely seen; is positively amazing. On one occasion a Miri led me to a small 'bhil' miles from anywhere in just such country without faltering, and was only a few yards out in his calculations although he had only visited the area once seven years before when looking for a lost elephant. All these jungle pools hold a species of very large water Monitor Lizard which burrows in the banks. These creatures are also now fully protected by the Assam Government. Not many of the usual kinds of duck are to be found here until towards the end of January and on into February, for until then the 'bhils' are clogged with water grass and weeds; but by about the middle of January these have died off and rotted away leaving the water clear, with plenty of feed. The ordinary sorts of duck seem to use this area as a kind of jumping off place on their way north at the end of the season. The Himalayan (Abor) foot hills are only 15 miles or less to the North. The birds begin to collect in large numbers in February and my best bag was made on the 23rd of that month. By the end of March very few birds remain. In February the ground is covered with dry leaves so shooting becomes a contest between the alertness of the birds and one's ability to move down to the water edge, often on hands and knees, as quietly as possible and without disturbing the undergrowth —no easy task. A single mistake and there would be a startled sound of wings. Not a feather would be seen in such circumstances for the jungle is too thick overhead.

The usual method was to crawl down to the water along a game track avoiding the worst of the cane and general unpleasantness and having got that far safely to take up a position behind the outermost fringe of jungle. A liberal plastering of mud by this time acted as a camouflage! The birds were put up from the other end of the 'bhil' and they came past the gun if things had been well calculated and one was well hidden. Fun was fast and furious while it lasted, which was not long, for the birds very soon disappeared over the trees. They apparently cleared off altogether for a shoot over these 'bhils' never caused the birds to go from one to another close by. Matters were somewhat complicated by the birds dodging in and out of the dead tree trunks and more often than not the charge of shot went into a tree instead of into a duck! Leeches were at times a great nuisance also. The commonest bird was the Common Teal (*Nettion crecca crecca*). The next most plentiful was the Mallard (*Anas platyrhyncha*) followed by the Gadwall (*Chaulelasmus streperus*), White-winged Wood-Duck, and Spot Bill (*Anas poecilorhyncha*) in that order. I unfortunately did not determine the local race of the last named except in one case which proved to be a curious aberration midway between *zonorhyncha* and *harringtoni*. This bird was recorded in the *Journal* (vol. xxxix, p. 638, 1937). The Garganey or Blue-winged Teal (*Querquedula querquedula*) is extremely rare, so far as my experience goes, and I only secured one and saw no others. Similarly the Red-crested Pochard (*Netta rufina*) is very rare and I only saw one specimen. There are only a very few pairs of the Pink-headed Duck (*Rhodonessa caryophyllacea*), now also completely protected by the Assam Government, and I have only seen one bird which must have been this species. This last species must be dying out for some obscure reason for hardly anyone shoots duck in the area and the birds are very rarely disturbed.

The Tufted Pochard (*Nyroca fuligula fuligula*) and the White Eye (*Nyroca rufa rufa*) are irregular in their incidence from year to year and not at all common. I have only shot one of each and not seen more than thirty or forty of each species. The Shoveller (*Spatula clypeata*) always found in pairs, is more common but very wary. The Pintail (*Dafila acuta*) is met with in fair numbers at times but is more of a migrant only. A curious fact is that most of the Pintails met with by me were immature birds. This species apparently prefers more open water and the young birds had not evidently acquired this habit. There is a small flock of Common Whistling Teal (*Dendrocygna javanica*) resident on a piece of open water in a patch of grass land near Koplong; but curiously I have never seen a Cotton Teal (*Nettapus coromandelianus*) anywhere in the District although it should be present in large numbers. Riverine duck shooting as opposed to shooting in the depths of the jungle can also be quite amusing —and profitable—for I was lucky enough to secure the second record of the Long-tailed Duck (*Clangula hyemalis*) in India on the Brahmaputra which was also recorded in the *Journal* (vol. xxxviii, p. 193, 1935). The Brahminy (*Casarca ferruginea*) is common everywhere on the Brahmaputra and Lohit rivers and curiously enough is not at all shy, possibly because they are not chased by every gun in the neighbourhood as they are everywhere else. I found them very rank, though one made excellent soup! All the rivers and hill streams of any size always have a large quota of Merganzer (*Mergus merganzer orientalis*) dashing and splashing about in the white water of the rapids, except where it is fiercest, after small fish. They can provide some very pretty shooting when the river is narrow enough. They will seldom deviate from the course of the water when driven. The gun can stand right out in the open and they will not take the slightest notice or alter their course in any way. They can fly very fast indeed especially down-stream in the hills, and good shooting is necessary for a good bag. The birds are by no means wasted, for the Abor camp followers greatly appreciate them; though I found them absolutely uneatable. I could never get past their rankness when cooked —skinned or otherwise. These birds have a very pretty and curious habit when cruising in calm water of arching their necks (especially the males) and then thrusting their beaks vertically skywards with a kind of darting motion. I feel sure this is not due to the effort of forcing an extra large meal down the gullet but seems to be a sort of game.

The Smew (*Mergellus albellus*) I have never seen although it is reputed to occur on the rivers of the District; nor have I come across the Widgeon (*Mareca penelope*) though it is said to be found just outside the Sadiya boundary in the Lakhimpur District. Stuart Baker records the Scaup (*Nyroca marila marila*), from the Lakhimpur District on the borders of Sadiya; but I must have missed seeing it.

The Spot Bill (*Anas poeciloryncha*) undoubtedly breeds in the district for I have seen them in September. The White-winged Wood Duck and the Common Whistling Teal are also resident and must nest.

It may be worth while recording that on one occasion I shot a female Common Teal on a small bog at Pangin about 40 miles into the hills and at an altitude of between 2000 and 3000 feet during the winter of 1934-35, and I also saw a large flight of Spot Bill in the Brahmaputra gorge in the same area that year.

Geese are met with fairly frequently on the sandbanks of the Brahmaputra, but very few are shot; and I have secured none, as they are too wary and unapproachable. I understand there is a particular area on the Dihang River between Pasighat and Kobo where large numbers of geese collect at the end of February and during March just prior to their migration to Tibet; but I have not seen this spot and am unable to say anything further on this subject, although I think it must exist because of the well defined migration route of geese over the village of Dambuk not far away. In connection with this migration route, which I have recorded elsewhere (*Journ. B.N.H.S.*, xl, 764-765, 1939), further enquiries show that this is used by geese far more on their northward flight than on their southward migration; only comparatively few birds coming south this way, unless they pass unnoticed at night. I have never been in this area during the time the southward migration would ordinarily take place, so it is difficult to say what the position is exactly about the southward flight and further investigation is necessary on this point.

I cannot say anything about the species of geese found in the Sadiya Frontier Tract for I have never got close enough to identify any I have come across and the ones that have been shot, I have not had the opportunity to examine in the flesh.

Most of the Sadiya Frontier Tract forms a large natural sanctuary for Duck of all species as they are very rarely shot at or disturbed and I feel sure there is much of great interest still to be found there, especially with regard to the inter-gradation of races when one considers that the District lies at a point on the map where it is possible that the Far Eastern, Burmese and Indian races overlap to a certain extent.

R. E. PARSONS,
F.R.E.S
Indian Police.

NOWGONG,
NOWGONG DISTRICT,
ASSAM.
July 25, 1939.

X.—THE NOMENCLATURE OF BIRDS.

All interested in Birds are recommended to read again the admirable letter of Mr. Hugh Whistler's in the Society's Journal of June 15, 1931.

It contains a timely warning of the dangers of the trinomial system that has been adopted—and its truly dreadful term of 'subspecies'. This is indeed a 'supercream' product of taxonomy —and we may expect a further enrichment of it into 'super subspecies' and 'infra-subspecies' very soon unless we return to sanity in nomenclature.

Few will agree however with Mr. Whistler's statement that 'the millennium of all good zoologists is uniformity of Nomenclature'. Nomenclature is nothing of real importance in Ornithology. It is but the technique of arrangement and is no more important than the technique of painting in the Art of Painting. We must ever be on our guard against allowing technique to be our master —it is but a humble servant to us in our Science.

Nomenclature has then to *serve us,* and so let us chastise it and mould it to our will that it may serve—and not direct us. A suitable system must be devised then for international use as free of error and absurdities as is possible.

It is not difficult to predict that the present system of dog-Latin appellations will soon be scrapped entirely and simple symbols as in chemistry adopted. When Chemistry was in its infancy we had the simplest chemical compounds and elements called by the most fantastic terms that had to go as soon as the science became serious. Such a cleansing and approach to reality is what is now called for in Ornithology.

Biology is the Science of Truth—and we do not serve her by the perpetuation of error. If the minor sciences of Biology disobey her principles they must be chastised and corrected. Ornithology needs correction. The most important thing in Ornithology is knowledge of the Living Bird—and not thousands of their remains in pigeon-holes in museums. While we must have a recognised scheme of nomenclature let us be under no illusion about the arbitrary system we are forced to adopt. It bears so little relation to truth that as soon as that is recognised we have no difficulty in recognising nomenclature for what it is worth.

At present because a black bird was called the 'snowy finch' in 1735 we have to perpetuate error and absurdity today by continuing to call it the 'snowy finch'. What effect does this have on people inclined to take up ornithology? Then in 'Latin' we have, *Corvus splendens splendens*—what do they think of that example of erudition? Well we all know—or should know, that the public laugh outright and laugh heartily. We want to attract the public to the science of Ornithology—for their own sakes—for the sake of science and for the sake of the conservation of wild life—not to choke them off and send them off with a contempt for ornithology!

Sweet reasonableness then must be the order of the day—and honesty and an open countenance—not the jealousy and secrecy of the medicos and alchemists of ancient times.

The first thing to do in nomenclature is obviously to put our own house in order before we set out to teach the whole world—that is we must settle upon suitable names in English for our birds. The English should hold an honoured place in ornithology. I advocated a long time ago that the Bombay Natural History Society took this matter up for the birds of the Indian region and published the lists of English names for public criticism with the object of gradually settling upon suitable names for each species. We should then promptly get rid of the 'snowy finches' and all such absurdities. This is not a difficult undertaking at all. The list might be easily and quickly revised again in twenty years time, and brought up to date.

Mr. Stuart Baker has led the way here in a wide correction of the English names in the new Fauna—cutting out peoples' names that were associated with various birds. That admirable correction cut out vanity also—and the elimination of vanity in Ornithology is a very pressing need indeed. Ornithology is too good to tolerate within it the corroding cult of self and vanity.

That excellent start in cleansing the temple must be followed up in future works by the elimination of people's names in the 'Latin' nomenclature. The adoption of commonsense symbols in place of the present day clumsy and absurd dog-Latin nomenclature is not likely to take place for some time if we consider the frenzied heat with which the pundits of taxonomy defend it. While an individual may suggest such a reform he can hardly go further than elaborate it and submit a scheme based on that principle. That is work for a representative Committee of International Ornithologists.

It is suggested that they undertake this task.

But for the immediate future, pending reforms, we can at any rate suggest that the atrocious term of 'subspecies' be killed and the proper and decent term of 'race' substituted.

Then, secondly, we can suggest that in all future bird books race receives its proper appreciation under the species—and is not exaggerated as at present in its presentation to the public on a par with species.

Let us hope that in future each species of bird will have its races—if any, described under that species and not as at present separately.

At present in the Fauna we have:—

No. 11 *Corvus splendens splendens.*

Then the races of this species are given separate consideration to as if they were different species! we have No. 12 *Corvus splendens zugmayeri*—and then again under another heading No. 13 *Corvus splendens insolens*—then again under another heading No. 14 *Corvus splendens protegatus.*

The result of all this is to exaggerate the importance of race, and the beginner in ornithology for whom these books are intended is apt to regard all these races as if they were different species of birds which they are not of course. The presentation is wrong—and the presentation is of great importance to people learning the science of birds.

It is then suggested that the proper way to present these birds would be to as follows:—

No. 11 *Corvus splendens* (NOT splendens splendens please!) and its races follow under the same heading—

Race 1. The Sindh race—*Corvus splendens zugmayeri.*
Race 2. The Burmese Crow—*Corvus splendens insolens.*
Race 3. The Ceylon Crow—*Corvus splendens protegatus.*

That finishes the House Crow and the next bird will be No. 12.

This is a presentation that is biologically correct and in order—and in proportion, and guides the beginner along the right lines—gives the right emphasis, and does not exaggerate the importance of race or give it false values.

It is largely due to the present over-emphasis on the importance of race that field naturalists and others are tumbling over each other in their efforts to discover 'new' subspecies (races) which they hope will be named after themselves—to perpetuate their vanity—or at least after a colleague that can be trusted to return the compliment at the earliest opportunity!

By getting proper proportion then in nomenclature we are also at the same time getting proportion in other values—in that, for instance, of self-esteem.

To recapitulate my recommendations:—

1. Nomenclature is not an idol to bow down to and worship—but only a convenient—or inconvenient arbitrary system drawn up to serve us.

2. That nomenclature now deserves the attention of the authorities who should review the present system and reform it.

3. That suitable English names for all our birds be adopted—to be revised again after a period of years.

4. That the present dog 'Latin' nomenclature be scrapped *in toto* and a simple system of symbols and numbers evolved to take its place.

5. That the present exaggeration of the 'subspecies' be put a stop to. That the term 'race' be used instead of 'subspecies', and that all races of a species be described *under that species and within the space* allotted to that species, and not under separate headings, in future works on ornithology.

6. That errors in ornithology are corrected and not perpetuated (as in History). Biology is a Science that can only progress by the recognition of truth and the correction of error—as in the Science of engineering. We do not perpetuate the mistakes made in the motor car of 1890 today—then why the mistakes made in ornithology of a past age?

7. That the association of peoples names with the 'discovery' of 'new' birds be put a stop to, to check vanity and the plethora of supposed races.

TAUNGGYI, T. R. LIVESEY.
BURMA.
November 3, 1938.

[A comment upon this letter by Mr. E. C. Stuart Baker is published below.—EDS.]

I have read with great interest the note in this number of the Journal by Mr. T. R. Livesey under the above heading.

This article really is, mainly, a comment on Mr. Hugh Whistler's statement that 'the millennium of all good Zoologists is uniformity in Nomenclature'. May I say at once that I am in complete accord with Mr. Whistler and with the hundred and one other Zoologists who long for this millennium. I cannot help feeling, however, that Mr. Livesey does not really grasp the full meaning of this hoped-for millennium and reads into the expression much more and yet much less than it really contains.

For the moment I will leave the question of the trinomial system alone and deal with 'Uniformity in nomenclature'. In the first place what does it mean? Briefly it presumes the creation of a system of *scientific* nomenclature in all sciences which shall be understood by every professor and every student, whatever his nationality, of that particular science in which he is interested. If such a system can be perfected it does not then matter in what language anyone speaks or writes, the mention or writing of a name accepted by that system at once conveys to the person who hears or reads it a full knowledge of what bird, beast, fish or other object is spoken or written about.

A very simple example of this use has occurred recently in my own experience. A most interesting little book has been written in German by Herr Wolfgang Makatsch on the 'Breeding-parasitism of the Cuckoo'. My knowledge of German is, I regret to say, very limited yet it suffices to enable me to understand all that is written so long as Herr Makatsch employs scientific names which are in common use for the various birds to which he refers, whether the name is in 'dog-Latin' or really good Greek or Latin. When, however, he employs trivial German names I am frequently at a loss, because these trivial German names are often unknown to me. This difficulty is one which can only be got over by the universal use of scientific names accepted by the whole scientific world. As Mr. Livesey knows, even in the same language there are often many trivial names for one and the same bird. Thus if in our English-written books we employ several names for the same bird, how is anyone, other than an Englishman, to know of what bird we are speaking? Most people in most countries who have learnt English know what we mean when we speak of the Thrush, but how many would know to which bird we are referring when we speak or write of 'Mavis', 'Throstle', etc.

Mr. Livesey says 'Nomenclature has then to serve us', etc. Surely it can serve us in no better way than in enabling us to understand one another and to know what we are talking about.

As regards Mr. Livesey's hope that our present method of nomenclature may be scrapped and symbols used as in chemistry, that I hope and am sure will never happen. Which is easier to remember 'H_2O' or 'Aqua'?

Before referring to our English names it is perhaps better next to deal with 'Trinomialism', i.e., the system of adding a third name to denote some geographical or environmental variation in a species.

First, does Mr. Livesey mean that we should refuse to recognize such variations? I think not and I believe that what he objects to is the admittedly rather cumbrous method of adding a third 'dog-Latin' name to the two already possessed by the bird. As I have agreed, the method is cumbrous but is there any alternative suggestion made by him as to how we should show that such differences do exist

If we may again take Mr. Livesey's example of the Crow, *Corvus splendens;* what method is the easiest when we wish to describe the effect of geographical or environmental selection on the various forms found throughout the great area inhabited by this species? I know that the last thing Mr. Livesey would wish is to lump together the almost white-backed bird of Sind with the practically black-backed bird of Ceylon and, if this is so, how can we draw attention to the variations more easily than by adding a subspecific name to the specific. The term 'subspecies' surely means 'something less than a species', i.e., 'geographical race' but it is rather shorter and so obviously refers to a bird as merely a variation in the species that I can, myself, think of no better term.

Naturally on the introduction of the trinomial system and the acceptance of the fact that species vary geographically, some ornithologists were much freer than others in accepting differences as sufficient reason for giving a name. My own system has been that no name should be given to a geographical race unless the variation is stabilized over a definite area and that birds occupying intermediate areas between such definite areas and which are themselves intermediate in *varying* degree should not be given any distinguishing name. If it is desired to describe such ill-defined forms—it very seldom is—they may be shown as $>$ or $<$ as for instance *Corvus splendens* > *zugmeyeri* or *Corvus splendens* > *insolens,* thus indicating that in the first the dominant characters were those of *splendens* and, in the second, those of *insolens.* Obviously it is impossible to lay down any degree of differentiation as being the standard by which a name should be given. A difference between true species is sometimes very hard to see and, often, far less apparent than the differences between races of the same species. If the difference is distinct under a careful examination and is, as I have already said, constant over a given area, then that difference should be acknowledged as sufficient reason for giving a trinomial.

It is now over 50 years ago that I first came up against the stumbling block of the geographical race. At that time I was living in Assam, an area where the typical Indian Avifauna blended into the typical Burmese Avifauna and in many cases, so far as written descriptions went, the birds I there obtained might well have belonged to either of two. At this same time also I was in constant correspondence with the late Dr. Ernst Hartert and, though it was before the time he had begun to use trinomials regularly, we had both already come to the conclusion that many of our Indian so-called species were merely geographical races of one species and some method would have to be evolved of drawing attention to this. I was able to supply him with much material from our Bulbuls (*Molpastes*) and Minivets (*Pericrocoti*) which proved that there were definite forms of these birds inhabiting different definite areas yet linked up in the intermediate areas by individuals neither one nor the other yet undoubtedly of the same species. At that time I would have liked to discriminate the first described form by the word *typicus* or *typica* added to the specific name but Nomenclatorial authorities preferred to show the typical race by the repetition of the specific name and so we get *Corvus splendens splendens; Molpastes cafer cafer; Troglodytes troglodytes troglodytes* and so on.

Thus far in disagreement with Mr. Livesey, now may I say in what respects I agree with him. Were I again to write the 'Avifauna' of India and able to follow my own methods[1] I should adopt the system suggested by Mr. Livesey. I should give my species II. *Corvus splendens.*

Then under IIa. I should give *Corvus splendens splendens* with a full description and full notes, including area occupied.

Then would come
IIb. *Corvus splendens insolens.*
IIc. *Corvus splendens zugmeyeri.*
IId. *Corvus splendens protegatus.*

and under each heading I would give the variations from the typical form in colour, size, etc., each sub-species; range and then differences in habits, breeding, etc., if any. This system, indeed, I did adopt with the exception of the numericals.

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[1] The different volumes of the Fauna were edited under the supervision of one man and the format was therefore the same throughout and, obviously, the various authors could not follow their own ideas on this subject.

Mr. Livesey suggests, however, that a full description should be given under II. *Corvus splendens* and no further description under the sub-species. This, of course, would be quite insufficient as *Corvus splendens* includes many races with great variations of plumage, habits and nidification, and one description could not be made applicable to all.

As regards trivial names I am also in complete agreement with Mr. Livesey and, as he remarks, have I hope, gone a long way towards creating a list of sensible and clue-giving names to our Indian Birds by the English names I have used in my work on 'Nidification'. To call a bird 'Baker's Scimitar-Babbler' or 'Livesey's Wood-Owl' can convey no meaning to the student, whereas, to call the latter the Shan Wood-Owl at once helps him to locate that bird. In 'Nidification' I have attempted to give birds names drawing attention to their most marked feature and, where there are many geographical races, adding a geographical name. Thus *Garrulax moniligera* I called 'The Necklaced Laughing Thrush' and the races I have distinguished by geographical terms.

Many of these names can be, and will be, greatly improved on. I would like to say, as I have so often said before, the 'Fauna' and 'Nidification' are, like all other works of the same nature, just a basis for further work and an incentive to other workers to confirm or refute what is written thereon. Already much has been done and the 'Vernay Expedition' and others sponsored by the Bombay Natural History Society have obtained so much beautiful material that numerous new races have been worked out, some old races eliminated and much additional information gained. There however, remains an immense amount of work for our successors, while the facts already elucidated will help others to know how and where to expect new geographical races and to give yet a few more trinomials to our heavily, yet quite rightly, burdened birds.

Mr. Livesey refers to the 'perpetuation of mistakes'. It is true that many mistakes are perpetuated by one writer following another but I think that, for the most part, mistakes are perpetuated not because the writer is too lazy to find out facts for himself but because the truth had not been ascertained and recorded between the times the author copied and the writer copying composed their work. The 'Fauna', I hoped at the time I wrote it, contained an up-to-date account of Indian Ornithology so far as it was then known and *recorded* but, since then, much has been found out (vide the last two volumes of Agenda and Corrigenda) and many corrections made to statements believed at the time they were written to be true and accurate.

Finally I would like to say a word on the importance of trinomials and geographical variation, though the first is merely the acceptance and method of naming the second. Surely geographical variation is nothing more than a phase in the long story of evolution, so that all the material we can obtain to show what these

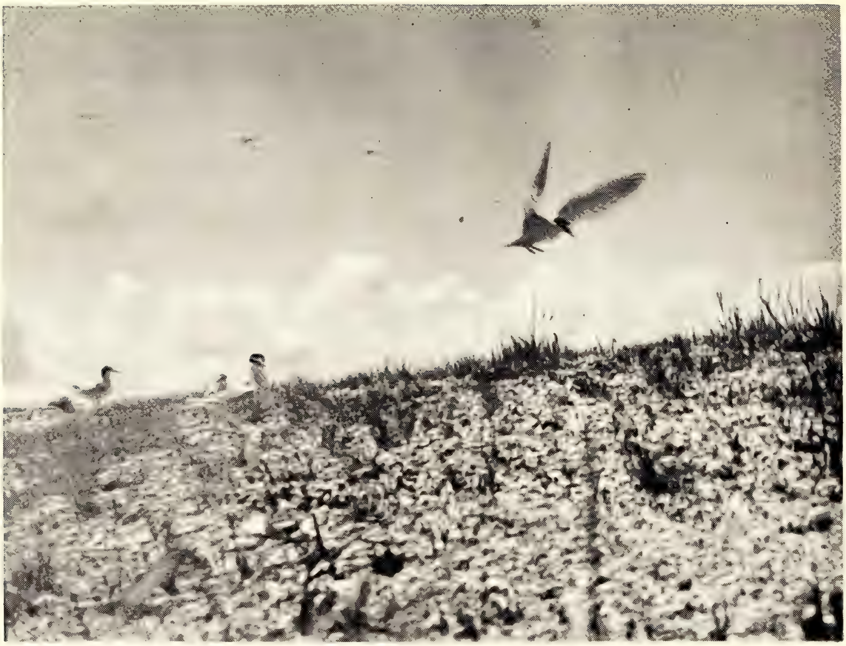


Photo by K. Fernandes. Ternlets at the nesting site.

Photo by K. Fernandes. The Island of Utan-Gorai where the Ternlets were found breeding.

variations are, how they are acquired and under what conditions, is material which can also be used in the greater question of the evolution of present-day nature.

January 26, 1939. E. C. S. B.

XI.—THE SUN AS A MORTALITY FACTOR AMONG YOUNG BIRDS.

(*With a plate*).

Early this month, I revisited the colony of Little Terns (*Sterna a. albifrons*) off Salsette, (vide *J.B.N.H.S.* xl, p. 635), with Messrs. McCann and Fernandes.

We landed at 10-30 a.m., and at our approach the birds left their nests and circled over-head. There were some 100 nests on the islet, all with two or three eggs. About six nests had a single hatchling with two eggs, and a cursory examination together with attempts to photograph the chicks and nests kept the parents off their nests. At 10-45 one of the hatchlings was seen to have collapsed, obviously overcome by the heat.

We immediately retired into a clump of mangrove some 15 ft. from the 'plateau' on which the birds nested.

The ternlets were back at their eggs in five minutes, and soon became so accustomed to our presence that we crept out of the mangrove, and were lying out in the open, with birds coming down to their nests hardly 10 ft. away. No bird, however, stayed on its eggs for more than a minute, and after about half an hour, we retreated and watched the birds from a distance. There was however no change in their behaviour. After a minute or so, the bird was replaced by its mate, and flew out to sea. With its head to the wind, it dipped, touched the water with its breast, and flew back to the nest. The shine on the eggs showed that they had been wetted, and the mate took off again to repeat the process. We watched numerous nests between 11 a.m. and noon, and the procedure appeared unvaried.

The first alarm and consequent exposure of about 20 minutes had proved too much for the hatchlings, and every one in a nest with eggs was found dead. The only chicks left alive were two in one nest, and these must, of course, have been slightly older than the single hatchlings with eggs.

The day was cloudless and hot, but did the parents react to changes in temperature? Or is this monotonous cycle of wetting the eggs and young instinctive, and kept on indefinitely throughout the incubation period? Do the eggs go bad as quickly as the chicks are affected? In *J.B.N.H.S.*, xxiv, p. 575. Currie has drawn attention to Black-bellied Terns (*S. melanogaster*) wetting their eggs at noon, and it is unfortunate that Uttan Washi is too difficult of access to permit detailed observation, The ternlets were seen carrying fish, and their remains on the islet seemed to indicate that they formed an important part of their food.

Many interesting questions appear to be raised by these observations, and notes from other sources would be of interest.

HUMAYUN ABDULALI.

BOMBAY,
June 28, 1939.

[Specimens of the fish forming the food of the terns collected by the writer were identified by Dr. Hora as:—

1. *Clupeoides lile* (C.V.)	...	... 7 specimens
2. *Scombermorus guttaties* (Bl. & Sch.)		... 1 specimen
3. *Hemiramphus* sp.	...	... 1 specimen

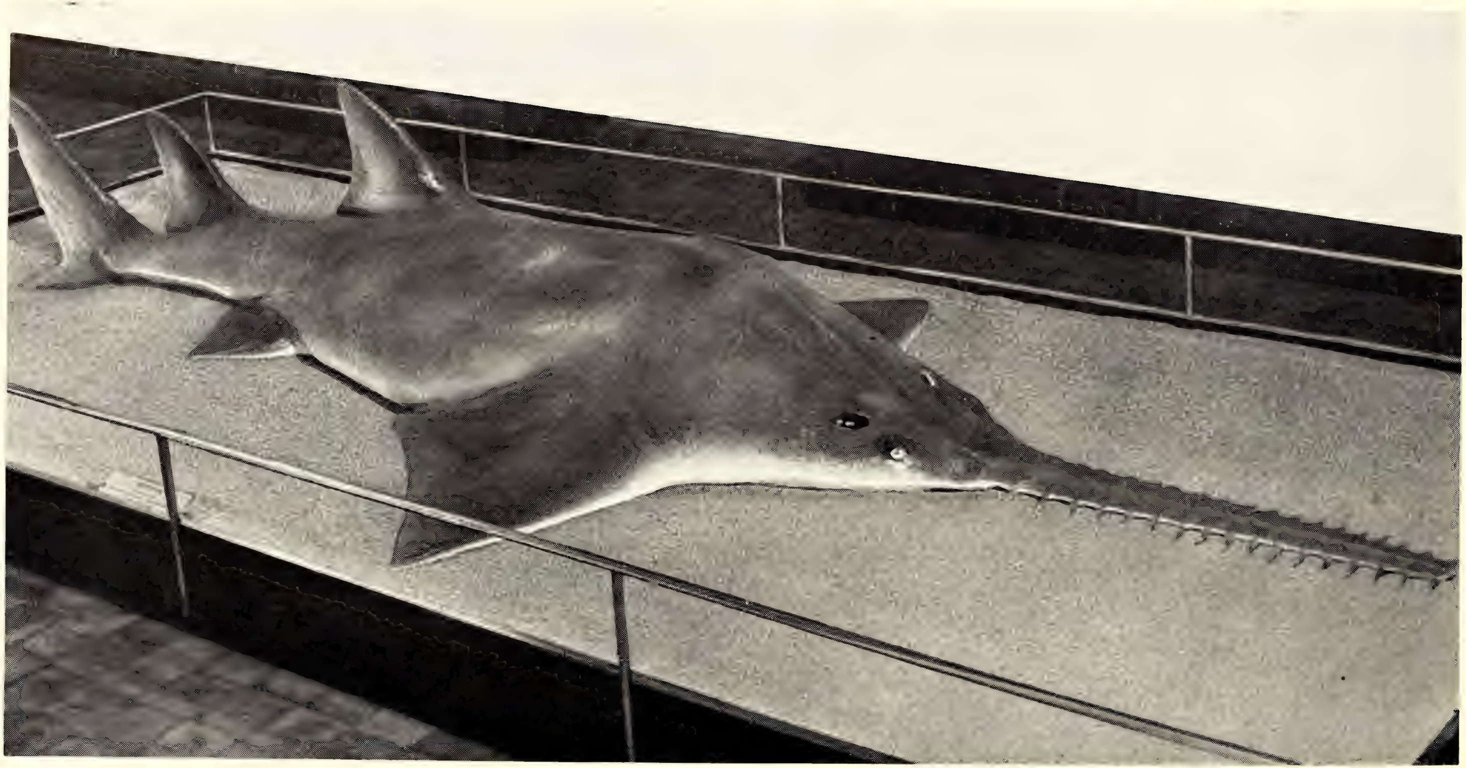
The instance recorded by Mr. A. J. Currie in his paper on the Birds of Lahore describes the nesting of the Black-bellied Tern (*Sterna melanogaster*) on the river Ravi at Lahore he says that 'During the middle of the day the birds do not appear to sit at but only to stand over their eggs to protect them from the sun and the eggs I found near Lahore were besprinkled all over with water—apparently as an additional precaution on the part of the birds to prevent them from becoming over heated'. The Egyptian Plover (*Pluvianus aegyptius*) is said to moisten its eggs in a similar manner. Dewar (*Birds at the Nest* p. 36) records that he noticed at Ghazipur that the eggs of terns and skimmers laid late in the season were all deposited on damp sand. Various means are adopted by birds to protect their eggs and young from the sun, particularly in tropical countries. Birds which lay their eggs on the ground in exposed positions resort to three methods of protecting them, *i.e.* covering them with sand; standing by or over the eggs during the day to shelter them from the rays of the sun; or, as in the instance of the terns recorded above, keeping them moist. Similar protection is accorded to the young by hovering with wings expanded over the nest during the hotter part of the day or in other ways using their bodies as a sun screen.—EDS.]

XII.—ON THE OCCURRENCE OF THE EUROPEAN REDSTART (*PHOENICURUS PHOENICURUS*) IN BRITISH BALUCHISTAN.

As regards my specimen of the European Redstart (*Phoenicurus phoenicurus*), I obtained one from a number passing through Robat in N. W. corner of British Baluchistan on 1st April 1939, and saw others I took to be this species at Kacha 40 miles S. E. of Robat on 22nd April 1939.

I sent my specimen to you, and you kindly sent it on to Dr. Ticehurst who identified it for me.

Phoenicurus ochrurus phoenicuroides (The Western Indian Red-



Giant Saw Fish (*Pristis perrotteti*, Müll. and Henle) caught at Back Bay, Bombay, 16th August 1938.
Photo of a cast in the Prince of Wales Museum, Bombay.

start) occurs in the Koh-i-Pushat and Raskoh range N.-W. and S.-W. of Nushki.

A. F. P. CHRISTISON,
Brigadier.

QUETTA BRIGADE,
QUETTA
August 28, 1939.

XIII.—ON A LARGE SAWFISH (*PRISTIS PERROTTETI* MULL. AND HENLE) CAUGHT AT BOMBAY.

(*With a plate*).

A sawfish (*Pristis perrotteti*) was caught by fishermen off Government House, Backbay, Bombay, on the morning of the 16th August 1938 and brought to beach on Chowpatty sands. A complete cast was made of the fish by the Museum staff, working far into the night and under considerable difficulties, not the least of which was the keeping back of the crowds which gathered to see the monster.

Colour. The general colour of the body was dull olive brown merging to dirty yellow on the margin of the flanks and fading to the white on the undersurface, the yellow is particularly prominent on the facial margin.

Eyes. Iris golden with a black centre and black edge.

Number of Teeth.—Right side 17. Left side 18. 1st four pairs opposite one another.

Measurements.—Total length 20 ft.

Rostrum, length—4 ft. 9 in.
Rostrum, width at base—1 ft. 2 in.
Rostrum, width at tip—5 in.
Tip of Rostrum to 1st dorsal—11 ft.
Tip of Rostrum to 2nd dorsal—14 ft. 10 in.
Tip of Rostrum to base of caudal—17 ft.
Anterior margin of 1st dorsal—2 ft. 4½ in.
Posterior margin of 1st dorsal—1 ft. 9 in.
Anterior margin of 2nd dorsal—2 ft.
Posterior margin of 2nd dorsal—1 ft. 8½ in.
Caudal anterior margin of upper lobe—3 ft. 4 in.
Caudal posterior margin of upper lobe—3 ft. 3½ in.
Pectorals: total span—8 ft. 7½ in.
Interorbital space—1 ft. 2 in.
Diameter of eye—3½ in.

The fish was caught in a net set for Ghol (*Sciaena*) and caused considerable damage before being dragged ashore.

BOMBAY,
August 30, 1939.

S. H. PRATER,

XIV.—THE NESTING HABITS OF THE GOURAMI (*OSPHRONEMUS GORAMY*).

In vol. xl. No. 4, May, 1939, p. 766 of your Journal Mr. Jones 'On the nesting habits of the Gourami (*Osphronemus goramy*)' mentions the various authors who have contributed on this subject but evidently is not aware of an article by Hilario A. Roxas and Agustin F. Umali on 'Fresh-water Fish Farming in the Philippines' (Philip. Jour. Sc. vol. 63, 1937, p. 443). In this paper the authors deal with the bionomics of Goramy and the following extract is illuminating on the question of the nesting habit of *Osphronemus goramy* :—

'In the Philippines, and under the conditions obtaining in the artificial concrete ponds of the Bureau of Science, where the bottom is muddy, the water stagnant, the temperature at the surface ranging from 27° C. to 32° C., and where there is no vegetation except patches of water hyacinths, *Eichornia crassipes* (Martius), confined along the sides by means of a wire stretched taut, the giant goramy breeds the year round, although the peak of the breeding season occurs during the warm months, from March to May.

'On spawning, the goramy pair off, and each pair selects a suitable place along the sides of the tank just beneath and along the edges of the patches of water plants. The vegetation preferred is an aquatic plant that grows on the surface of the water and whose floating roots, which rise and fall with the surface of the water, form natural galleries under which the fish can conceal themselves from public gaze and disturbance.

'In the pond, among the water hyacinths and a little below the surface of the water, the goramy attaches its nest. The nest is composed of plants, mud, and other available floating or submerged materials. Its shape varies from somewhat spherical to oval, and in form it resembles those of some birds. Table 4 summarizes the features of nests A, B and C, all of which were actually recovered from goramy ponds in the Philippines.

'The size of the nest varies with that of the fishes, while the materials of which it is built depend upon whatever is procurable in the feeding or spawning ponds. It takes about a week for the goramy to build its nest.

'When the nest is completed, the female deposits her eggs in the centre of it. The eggs are round, shading from orange to yellow, and about 1 millimetre in diameter. After the eggs have been deposited and fertilized, the parents remain near, patiently aerating them by the constant fanning movements of the pectoral fins and zealously guarding them from predators and enemies.

'The eggs hatch in about 10 days. Plate 2, figs. 1 to 4, shows various stages in the development and metamorphosis of the fry, from the time the individual is newly hatched until it reaches the age of 1 month and 12 days, when the appearance and shape of the adult become evident, and when the first ray of the ventral fin is distinctly beginning to prolong. The young find refuge in the nest during the first days of their life, under the protection of their parents; they do not soon disperse, but keep together in schools under the guidance of the parent fish.

Table 4. Summarized features of goramy nests recovered from ponds in the Philippines.

Nest	Date recovered	Locality	Measurements			Contents	Composition
			Cm. Length.	Cm. Width.	Cm. Depth.		
A.	Nov. 10, 1932	Manila Propagation Ponds.	30	18	9	Remnants unfertilized eggs that have become decayed, soft and mossy.	Roots, stalks, and leaves of water hyacinths ; rattan ; vines for tying kangkong, the feed of the fish ; stalks of *Hydrilla verticillata* ; mud.
B.	Aug. 16, 1935	Do.	28	20	10	Newly hatched fry, with yolk sacs and some decayed unfertilized eggs.	Mostly roots, stalks and leaves of water hyacinths with scatterings of mud.
C.	Oct. 19, 1935	Mexico, Pampanga.	28	26	10	Unrecorded.	Grasses and twigs made compact and somewhat woven with roots of grasses and some wire, and pasted with mud.

DEPARTMENT OF FISHERIES,
COLOMBO MUSEUM,
COLOMBO.
June 19, 1939.

C. AMIRTHALINGAM,
B.SC., PH.D.
Actg. Asst. Marine Biologist.

XV.—TROUT FISHING IN KASHMIR.

(*Wtih a plate*).

I have been fishing in Kashmir on and off for the last eighteen years or so. Last year I managed to put in nearly three months, and, as I fished most of the beats now open to the public, it is rather interesting to look back and consider how the original experiment of stocking these streams has fared.

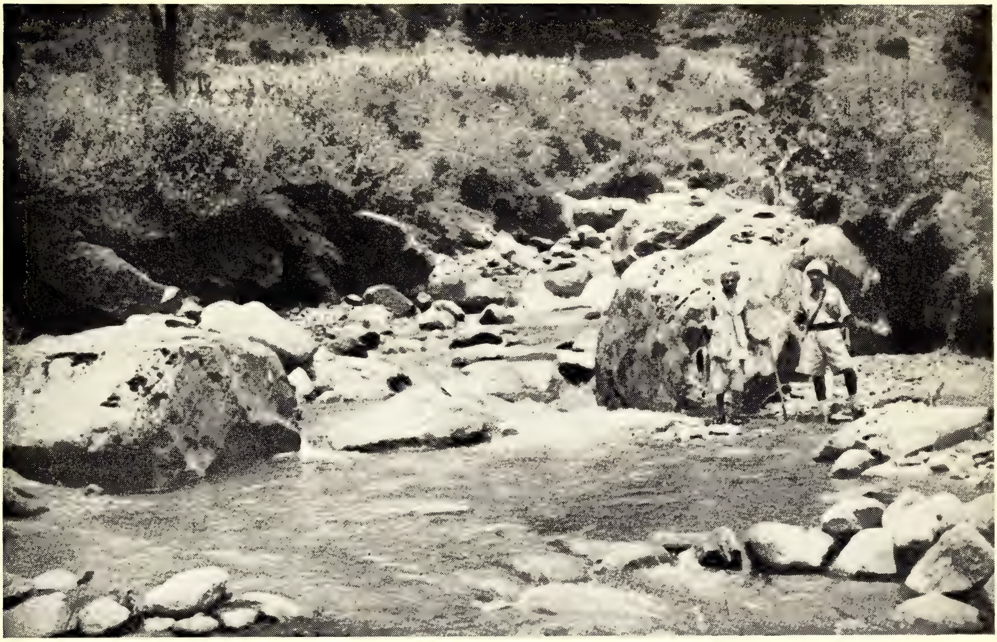
Brown trout were, I think, first introduced into some of the streams about 1901, and, after a few initial difficulties, throve and multiplied exceedingly. I have no first hand knowledge of these very early years, but, from all accounts, a large number of very big fish were killed from about 1908 up to the outbreak of the war. My own experiences started in 1920 when I was lucky enough to be able to spend nearly a whole summer on the Kashmir streams. At that time the state of the rivers was peculiar and the fishing was quite unlike any I have met elsewhere. There were on the whole very few medium sized fish. There were however a large number of really big fish, while in most streams there were quite a lot of fish of 6 to 8 inches, showing that natural breeding had got a good start. The fishing, however, was unlike most trout fishing. One spent one's time trying for the very big ones, spinning where spinning was permitted, fishing a large sized salmon fly or lure elsewhere. This was the golden age as regards big fish. Trout of three pounds and over were ordinary, 5 and 6 pounders were quite common, while fish or 8 to 10 pounds were no great rarities. My own best fish was one of eight and a half pounds, while I had quite a number of between 5 and 7. To show what the average then was I will quote two bags—one of 24 fish killed in a week on the Lower Bringhi weighing 78 lbs., and another of 6 fish killed on the Naubug in one day weighing no less than 29 lbs. There was lots of other sport to be got in those days, for from my camp at Wyl on the Bringhi I got a black bear in the morning, an 8½ lb. trout in the evening and over 50 Chukor to my own gun next day.

The trout in these days were in marvellous condition and I have never seen finer fish than these Bringhi trout. They looked perfect, they fought well, while on the table they cut like fresh-run sea trout.

About 1931 there came a change in all this, and it looked as if something had gone radically wrong. Rivers like the Bringhi, which had formerly been famous for the quality of their trout began to fall away. People began to haul out a lot of medium sized fish in poor condition, and, although there were still a certain number of big fish about in really good condition, the majority were poor and lanky. It was quite obvious that something had gone wrong with the food supply, and it looked as if the glory was departing for ever from the Kashmir streams.

Looking back I put this falling away down to a combination of two causes. There were, I think, tremendous floods in Kashmir in either 1928 or 1929. These scoured out the beds of the rivers, and, worse, cleaned out the side streams altogether, so that many of them which had held masses of watercress and other food harbouring weeds, were reduced to barren streams trickling over bare gravel and silt. This meant an immense and sudden drop in the food supply.

This happened, moreover, just at the wrong period, when natural breeding of trout had begun to get ahead of the normal food supply. The result was a regular famine, and overstocking of the worst kind. I can't help thinking that the State fishing rules also contributed to this state of affairs. These allowed far



THE CHATERGUL.
Burn fishing on a large scale.

MY LAST DAY—UPPER NAUBUG.
Best $3\frac{1}{2}$ lbs.

too few trout to be killed by license holders, so that there was nothing to keep the stock under control. As a result the stock of trout far outran the food supply. One can hardly blame the State authorities, however, for it is only recently that people, even at home, have begun to realise that overstocking is worse than understocking and much more difficult to remedy.

After my experiences in 1931, therefore, I was not too optimistic about last year's fishing. I am glad to say, however, that on the whole I was agreeably disappointed. There is undoubtedly a great deal of overstocking in most of the rivers. But nature is definitely beginning to strike a balance, and the trout, though much smaller on the average than they used to be, are on the whole in better condition than they were a few years ago. There are doubtless some of the old stagers left, but the trout are now striking a natural average and one which is balanced by the food supply. Another point is that the fishing is becoming more like real trout fishing, and instead of hurling enormous bunches of feathers into the streams, it now pays to fish really fine and with the smallest possible flies. My five best fish this year, all of which weighed over 3 lbs., were caught on 00 midges or something similar, sometimes fished wet and sometimes dry. It is in fact trout fishing now, and that is what we exiles are looking for.

This state of affairs does not hold in all rivers, however, for many of them are in earlier stages of development. The Madmatti and the Kishengunga, for instance, which are very large streams, and were stocked later, have not yet reached this natural balance, and at present are in the early stage of holding a lot of big fish in first class condition. It will be interesting to see how their stock develops in the years to come.

Now, as to the rivers themselves. There are about 25 beats open to the public, and I understand these will very soon be increased to thirty or more. With as many beats as these there must be a great variety both in the type of water and the method of fishing, but the beats can be roughly divided into three main masses.

Firstly there are the extreme upper waters of the big rivers and some of their smaller mountain tributaries. These are real torrents, and fishing them is glorified burn fishing. But though the methods are very like the tactics employed on a highland burn at home, the results are very different. In these streams a small bright fly, let it be a small Jock Scott, a Cock of the Walk, or a Silver Grey, will bring up a trout from behind almost every stone. These will be no fingerlings, however, like our wee burn trout, but will be lusty fish, eight or ten inches or more, while many of them will scale 1½ or 2 lbs. and will be fine fish at that. On a good day, however, they will be just as eager as our hungry little moorland trout. In this class are streams like the Chatergul, the Deosoo and the Mantar, and very fine little streams they are.

Further down, where the valleys open out, we get typical South-land trout streams, the Kokarnag, with its green watermeadows, and its overhung shady stickles, and the Naubug with its grassy willow planted flats. These to my mind are the best of the Kashmir streams, and here is real trout fishing, not a gaudy oriental imitation. The dry fly man will come into his own here, and many a fine trout will come up at a well cocked dry fly floated down the runs between the weeds at the tail of the pools. A word of warning, however. There is very seldom a real hatch of fly on any of these streams, and the dry fly fisherman will not do well if he waits to tackle only a rising fish. Sometimes he will see his fish, more often not, but big fish lie under the weeds at the edge of almost every narrow channel, and a dry fly run down one of these will nearly always get its reward. On almost all the big rivers, too, there are little side streams, mill leats and the like, which nearly all hold good trout, and where a small fly fished either wet or dry will kill fish even when the main river seems quite hopeless. In all this type of water do not forget the nymph. These Kashmir trout, although they are not tremendous surface feeders, are very fond of taking nymph under water, and they love grubbing about amongst the weeds for any minute life they can find. A nymph sunk quickly and fished past any weed bed is very killing at times, and will often bring up fish in the middle of a bright sunny day when they will look at nothing else.

The last class comprises the middle and lower beats of the big rivers, the Bringhi proper, the Sind, the Liddar, the Madmatti and the Kishengunga. These are like vast salmon rivers, with heavy rapids and great sweeping pools. Here you will want big flies and spinning tackle. Remember in these, although the big tempting pools do hold a certain number of trout, there is more feeding and consequently are more trout in the lighter water. Spend most of your time, therefore, on the bouldery streams where the river divides, the shallow tails of the pools and the like, and especially where any weedy side stream flows into the main river. You are fishing for trout, not salmon. Salmon are not worried by the food supply question and lie out in the big pools. Trout follow their food, and where there is feeding, there will you get them.

And now to some conclusions as to the fishing as a whole. Well, it is first class, but it might easily be much better. We owe all of it to the Game Preservation Department of the State, and it seems ungrateful to be critical. I am sure, however, that there are many points where improvement could be effected, without any serious difficulty or great expense. The first and most important question is that of overstocking. In nearly all the rivers natural breeding appears to be unusually good and there is a very marked tendency for the natural stock of trout to outrun the food supply. This is especially so in the Bringhi area where overstocking has already got out of hand. I am sure the aim in trout preservation should be quality, not quantity. It is far better to have a medium stock of well conditioned fish, than a tremendous quantity of poor conditioned small ones. Here quality is deteriorating, for the food supply is not keeping pace with the increase in stock. If the situation is to be saved immediate action is needed to set this balance right. The first point is, I think, a reduction in the number of trout. Trout in Kashmir have very few active enemies. There are no pike or other seriously predatory fish. There are a few otters, and a few herons and kingfishers, but not enough to have any serious effect in keeping increase within bounds. The only real agent in keeping down the stock is the licensed angler, and I do not think that he is allowed to kill enough fish to have the desired effect.

Take a river like the Bringhi. On this, counting small tributaries and side streams, there must be at least 40 miles of fishable water, divided into 6 beats. On each of these each rod is allowed to kill 36 fish a week, while two rods are allowed at a time. This makes a possible total of 72 fish per beat per week for the 6 months of the fishing season. There are, however, weeks of spate, of logrolling and other interruptions, and it is doubtful whether the average can be more than 50 trout per week per beat, or 1,200 for the season. In the six beats, therefore, probably an outside maximum of 7,000 fish are killed during the season.

Now the Bringhi is a big river, with plenty of holding water, and I cannot think it holds less than 5,000 mature trout to the mile. In the whole river, therefore, there must be total adult population of not less than 200,000 trout. The 7,000 or so trout killed per year can hardly have any appreciable effect in keeping this vast population in check, and the result must be an ever increasing amount of overstocking. I am sure it would pay to do away with the limits both with regard to size and numbers on every license, and allow, nay even encourage, every angler to kill every trout he possibly can irrespective of size. It might in fact be advisable to reverse the present policy, and, while still limiting the number of sizable fish to be killed, to make it compulsory to kill every fish taken under the present size limit. This experiment, to have any real value would have to be carried on for a number of years. I am sure it is not at all a dangerous one. While it is very difficult to cure overstocking, to cure understocking, where natural reproduction is good, is very easy. Should it be found after a number of years that the stock is getting low, it is only necessary to restrict angling for a year or two and the stock will quickly recover, while in the meantime natural food will have had a chance, in its turn, of increasing. Personally I would recommend being more drastic still and netting out a large portion of the existing stock.

Another point which needs immediate and drastic treatment, is the enormous stock of country fish in the river. The whole Bringhi is almost paved with country fish, both in the shallows and in the pools. Late in the year if you look into the pools you will find that you can hardly see the bottom for them. It is argued, I know, that the fry of these fish make excellent feeding for trout. This is true up to a point, but trout feed far more on water insects than they do on fish, and, in any case, their slight value as trout food must be quite outweighed by the damage they do to the normal sources of food supply for trout. I do not think any one knows with great accuracy the diet of these country fish. Their staple is probably vegetable matter, green slime and the like. I am sure, however, that they will eat most things, and that they consume or destroy caddis worms, snails and other smaller forms of life, which are the most important ingredients in the trouts diet. Further they certainly interfere with the growth of weed, which is the natural host of most of the trouts food. Finally they cause unhealthy crowding, they must use up a tremendous lot of the oxygen in the water, while their excreta, where they exist in these enormous numbers, cannot fail to foul the bottom of the river. I am sure that a few days careful netting of the river would result in a catch of several hundred tons of these country fish, and would, if a market were organised, be a paying proposition. Even if a fair number of trout were killed at the same time, good, and not harm, would result.

Lastly, and possibly most important of all, is the question of improving the natural food supply available for the trout. Now that most of the rivers are either stocked to capacity, or at least well enough stocked to be left to natural breeding, it seems to me that a large proportion of the money now spent on trout hatcheries might be devoted to breeding food supplies. Much might be done, too, by paying more attention to the minor feeders. These might be turned into food breeding sanctuaries. Food harbouring weeds might be planted, and protected, and the scientific breeding of fresh water snails, shrimps caddis fly and the like might be taken up. The Kashmir streams, like all other Himalayan waters, are woefully deficient in waterflies and it is for consideration whether some of our British waterflies, mayflies and so on might not be introduced. One thing is quite certain. Money spent on increasing the stock of trout on most rivers is now money wasted. Any expenditure which really helps to increase the available food supply is certainly money well spent.

In conclusion, because I seem to be overcritical and to find fault rather than praise, do not let it be thought that I fail to appreciate the admirable work done by the State Game Preservation Department. It has indeed accomplished wonders, and we poor exiles owe to it some of the best of our days out here, and some very wonderful sport. I do feel very strongly, however, that work on the lines I have suggested would raise trout fishing in Kashmir from its present level of merely first class, up to a standard which could hardly be equalled anywhere else in the world.

LORALAI,
BALUCHISTAN,
June, 1939.

E. J. ROSS,
Brigadier.
Zhob Brigade.

XVI.—A CURIOUS HABIT OF A DANAID BUTTERFLY.

During May and the first half of June this year there were extraordinarily large numbers of the butterfly *Danais melissa dravidarum* Fruh. on the Billigirirangan Hills (Mysore-Coimbatore). Throughout large areas of dry evergreen forest at an elevation of about 4,000 ft. swarms of many thousands of these butterflies were frequently met with. In this same area a wild species of hound's tongue, *Cynoglossum denticulatum* A. DC. var. *zeylanicun* C. B. C. is frequent, but at this season is not yet in flower. It was noticed that many plants of this species were completely covered with the above butterflies. These insects were engaged in vigorously scratching the surface of the leaves with the 'claws' of their front legs and drinking the sap thus made available. Each front leg has two slender sharp claws. As a result of this treatment the leaves become wilted and soon turn black or brown. The butterflies appeared to confine themselves strictly to this particular plant, and consequently it was difficult to find any plants of this kind that had not been thus attacked, at least to some extent; many plants had all their leaves completely shrivelled.

The Danaid butterflies were accompanied by a few of the species *Euploea coreta coreta* God. which were drinking the sap but which were not seen to take part in the scratching. The butterflies did not resort to this practice simply to get water, as there were a number of shallow streams in the district. This plant is not recorded as the food plant of the larvæ of Danais or Euploea.

The butterflies were kindly identified by the Madras Museum.

TAMBARAM, E. BARNES.
SOUTH INDIA.
July 9, 1939.

XVII.—'A CATERPILLAR PEST OF CHAMPAKA (*MICHELIA CHAMPACA*) IN SOUTH MALABAR DISTRICT.'[1]

The Champaka (*Michelia Champaca*), a well known and popular flowering tree in India is found thriving chiefly along the foot-hills and uplands of the Western Ghats. Apart from its value as a valuable timber tree, its sweet-smelling and beautiful golden flowers command a good market in all villages and towns. It is commonly cultivated round about temples and like the *Asoka*, *Malathi*, *Mandara*, etc. is one of the trees held in some veneration by Hindus in many localities. The writer has in his farm in the South Malabar District a few young trees; recently these were found subject to the attacks of a leaf-eating caterpillar. Since we have no records of any insects associated with this valuable tree from South India, the writer has attempted to present a short paper on the bionomics of this insect. The Caterpillar is the larva of the swallow-tailed papilionid butterfly *P. agamemnon.* L. The caterpillars feed on the foliage, and sometimes almost defoliate the branches especially is this the case with young plants. The attack is commoner during the rainy months from June to September.

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[1] Paper read at the Indian Science Congress, Calcutta, 1938.

The insect, its life-history and habits.—The butterfly is a fairly common species found all over the Indian region especially in tracts with a good rainfall. It is a beautiful creature with black wings with numerous green markings; there are a few brown and pinkish markings on their under side. The colour of the body is black generally, but there are a few grey or pinkish patches on the thorax and sides of abdomen.

Eggs.—The spherical smooth egg is pale yellowish green more or less the colour of the tender leaf, on the undersurface of which it is deposited.

Larva.—The egg hatches into a tiny dark caterpillar in three to four days. The newly hatched larva measures 2 mm. In colour it is blackish grey with a striking creamy white patch along the dorsal region of the posterior half of the body; the prothorax is also of a pale whitish colour above. Ventral region and legs are pale grey. The head is paler and is hidden underneath the prothorax. The dorsal and lateral regions are fringed with small branched spines, in addition there are four pairs of tubercular processes with minute spinelets on them. The first three pairs are on the thorax, one pair on each segment; these project posteriorly and laterally and become very conspicuous in the later stages. The mesothoracic and the abdominal processes are pale whitish to some extent, the other thoracic ones being dark grey. The small dorsal spines are arranged in longitudinal rows on either area of the mid-dorsal region; each of these small spines is bifid at the tip. At this stage the creature can be easily mistaken for bird's dung—evidently a protective adaptation. At the next stage the body colour changes to dark green, but the white patch still persists though paler in hue. The smaller body spines disappear leaving only the four pairs of processes and a smooth body; gradually the thoracic region gets swollen and hides the head completely from view. In the later stages the body takes a pyramidal shape with the middle of the body elevated up and sloping gradually towards the front and back. The spiny processes become reduced and shining black in colour, the mesothoracic pair becoming reduced to mere stumps with a golden yellow areola around the base of each; these processes now become spines, the spinelets on them gradually disappearing. From this stage onwards the larva often assumes the attitude of sphinx larvæ with the anterior region remaining raised up over the leaf level. When disturbed the caterpillars also thrust out the fleshy forked *osmateria* from the prothoracic region emitting a very strong odour—evidently a defensive adaptation generally found in most papilionid caterpillars.

The caterpillar during its last stage grows to a length of about 40 to 45 mm. and is stout and cylindrical though compressed a little dorsoventrally. The body surface is smooth. The general colour is bright to yellowish green according to that of the leaf surface. The ocelli, the four pairs of spines (3 thoracic and 1 abdominal) are blackish blue; the mesothoracic ones are considerably reduced to two small dark pinheads; the bases of the metathoracic ones have a crimson shade. The eight pairs of spiracles are clearly visible as grey spots over a yellowish green ground colour. Legs prolegs paler and greyish at tips, the latter very well provided with hooks and setæ.

Pupa.—The caterpillar changes into the chrysalis fixing itself by means of silk strands on the leaf stalk or branch carefully hidden from view, difficult to detect blending as it does with the colour of the pale green bark or stem. The chrysalis is about an inch in length and is more or less boat shaped with the conspicuous horn on the middle and narrowing towards each end; the tail end tapers and the head end is more or less flattish. The thoracic region is edged with a wavy brown border patch on each lateral side and these meet at the horn. The abdominal region is paler than the anterior half. The life-history roughly occupies about a month to five weeks. In the earlier caterpillar stages the creature is more or less like some limacodid caterpillars (Parasa, Contheyla, etc.).

It was not found breeding on any other food plant except *Champaca* in this region. Kershaw has recorded it from Hongkong breeding on Champaka and custard-apple and Senior White from Ceylon on *Anona*. There is however no record of its occurrence on this plant till now from South India.

MADRAS.
January 1938.

T. V. RAMAKRISHNA AYYAR,
B.A., Ph.D.,
Government Entomologist, Madras (Retd.).

XVIII.—BIRDS EATING BUTTERFLIES.

I had very interesting experience on this trip. A Paradise Flycatcher (*Tchitrea paradisi* Linn.)—the Malay name is *Murai Rimba,* which means the robin of the big jungle—was very interested in certain butterflies which during the sunny part of the day fed on the edge of the pool where, no doubt, they found succulent juices from the large accumulations of elephants' dung. The bird I saw at first was the male; later on, another day, I saw both male and female.

The flycatcher stooped at the butterflies as they were feeding on the ground,—I am not sure whether a bird does 'stoop' at butterflies—and after many failures I saw him catch a Fritillary and take it away to a tree where he pulled or broke the wings off and then flew away with what was left.

I think the female was on a nest where there were possibly young, because later on I saw her catch a large White and take it away. I saw these birds catch several butterflies, mostly Fritillaries, almost always on the ground but sometimes when the birds' swoop had disturbed them, on the wing. This is interesting in view of a paper lately read by Dr. Richmond Wheeler and published in the *Proceedings of the Linnean Society,* Session 151, April 1939, in which this matter was discussed. Wheeler was out here as a school master and I knew him well. I was always of the opinion that birds did *not* eat butterflies in Malaya and that was Wheeler's view too. This error was based on negative evidence. I know better now. I am writing to Wheeler telling him all about it, because although it destroys his previous convictions he is a big enough man to admit he was wrong and will be glad of my positive evidence. I saw these two birds on six days.

T. R. HUBBACK.

PAHANG,
FEDERATED MALAY STATES.
August 6, 1939.

XIX.—ON THE ROAD TO GERSOPPA AND BACK.

We decided on a short excursion to the Gersoppa Falls just at the break of the rains. To the layman, perhaps such a trip offers no thrills and no interests, but to naturalists it is full of experience. Nature is on the verge of rejuvenation and her children know the season and weather conditions even better than the most learned metreologist and finest instruments. An inherent 'something' drives them to prepare for the coming event—the monsoon. Birds move to drier or wetter climes as the conditions suit them—some to nests, others to dodge the rains: pupas of last season have matured and are on or about to take to wing: dormant plants are ready to sprout. Life is everywhere waiting to be released. Down comes the rain and it is in motion.

We left Bombay on the 4th June, 1938 in pouring rain. The monsoon had broken earlier than usual in spite of forecasts. In fact, it had rained a few days previously and Nature around had answered in response—it was green on all sides below the ghats. The lean cattle greedily fed on the sprouting green followed by the ubiquitous Cattle Egret (*Bubulcus ibis coromandus* (Bodd.)) in full nuptial dress. Along promising streams, where pools had already collected, the Lesser Egret (*Egretta i. intermedia* (Wagler)) congregated in small parties were also in their wedding wrap, full of promise and busily intent on the small life in the pools. Among these and belonging to the same class was our 'Issac Walton of the Ponds', the Pond Heron (*Ardeola grayii* (Sykes)) in his best wedding suit waiting patiently for his breakfast.

Outside Panvel we stopped on the bridge. A splashing of water attracted our notice and on looking down, below the bridge were a number of lads dressed in less than handkerchiefs damming up portions of the stream and bailing out water in the hope of catching small fish. Small fish have an attraction for the villager, not because they are easy to get or cheaper to buy, but they are tender and it saves them the trouble of removing the bones—the entire fish is eaten—it is really a labour-saving device and a saving in material. Nothing wasted, but no thought for the future.

In due course we climbed the ghats of Campoli. The Malabar Whistling Thrush (*Myophonus horsfieldii* Vigors) was to be heard but not seen—he is a skulker. At this season he is also in his best plumage and preparing his nest away in the cliffs. We stopped at the Khandala Hotel for lunch. While we waited for it we had time to investigate the neighbourhood. The results were not good, life was dull at the moment—a few metallic blue beetles (Chrysomelids) were lunching on *Pavetta indica.* We were glad to leave this unproductive spot as soon as possible.

Leaving Khandala behind we were now on the Deccan. The change was most remarkable though rain had fallen and was still falling. The fresh greens had given place to the drab kahki and black rocks and soil so characteristic of the Deccan. Rain had evidently been very recent. Bird life was scarce. Now here is a problem for the ornithologists. At most times, particularly during the dry season, the telegraph wires, those unconsciously erected bird perches, and dry branches are always tenanted by numerous Drongos, Rollers, Doves, and at times by Swallows and other birds. The Drongos and Rollers were not to be seen. During the whole length of our journey we only saw a single Drongo, and that near Belgaum which was close to forest. Where have these hundreds of Drongos and Rollers gone? It is quite evident they were absent from this part of the Deccan. Another bird whose absence was conspicuous was the Golden Oriole.

Such conditions undoubtedly point to a local migration. The season was the breeding season for most Drongos. The *Fauna* (2nd ed.) states the Black Drongo breeds throughout its habitat. It has been our experience that most Drongos breed in well forested (deciduous forest) areas. This reason may explain their absence in the Deccan where forests are wanting, for in the forested areas further south, Drongos were noticed. This might explain the absence of these birds, but what of the Rollers? According to the same authority the Rollers would be at the end of their breeding season. As these birds are not entirely dependent on trees for their nesting sites, frequently building even in masonry structures, their absence is not so easily explained. Lastly we come to the Oriole. According to the *Fauna* it is said to breed throughout its range during this season. In this case too, their total absence from that area at this time points to a definite breeding migration to more suitable localities. However, these casual observations prove nothing, but merely state the facts, which were most remarkable.

Towards evening we arrived in Poona, where we stayed the night. As the Poona rivers hold some sporting fish and it was still early, the Piscatorial Artist of the party tried the possibilities with rod and line, while the botanist hoped for something fresh along the banks; our host, who accompanied us, was torn between the two. The net results for the evening proved a failure for the fisherman, but the botanist had made a find. Our combination, it must be understood, was not merely a temporary union of fisherman and botanist—we were 'Naturalists on the prowl' ready for any emergency and to collect anything that came our way.

Next morning we bade adieu to our host and hostess and slowly threaded our way towards Belgaum. Mile after mile went by. It drizzled now and again. Little was to be seen on the drab undulating plateau, yet it was full of interest. Gypsies slowly threaded their way to their 'rainy' quarters, driving either buffaloes or donkeys before them laden with the family possessions surmounted either by small children or the family chanticleer, who frequently, loudly protested against this mode of travel, while dogs followed in their wake. It is a life of perpetual going to and fro. The further south we went the turbans of the locals became larger until they were fully pregnant in Kholapur State. In that state, the size, colour, and texture, with a characteristic kink on one side, almost closing one eye, evidently indicated the status of the individual.

Our host at Poona had confided to the Fisherman that at Sutgutti, 16 miles from Belgaum there was a river with *large* fish in it. This was sufficient reason to call a halt at a place, though, at first, we accepted the information as a 'fishing story'. We reached our destination towards evening, hurriedly had some tea and set out for the river. The sky was heavily overcast. Our guide to *the* fishing spot was an enterprising local youth who had evidently been out several times before. Like most guides he went round in circles—we were hurrying against time. On arrival at the spot we found a considerable pool. Occasional splashes and an occasional dorsal fin indicated the presence of really large fish. The fisherman got quite enthusiastic. He cast in all directions, now one line and then another, while the botanist looked on. We encircled the pool, but with every cast the fish only became livelier and often leapt out of the water with glee, as if taunting the fisherman and all his skill, but they would not bite. The fish were large carp. Some measuring almost three feet. the enthusiasm of the fisherman was such that he determined to visit the sport next morning.

Early next morning we were at the spot again, only to discover the cause of the activity of the fish the previous evening. They were more learned in 'fishy matters' and weather conditions than we. During the night it had rained heavily and it was still raining when we arrived at the spot. The river had swollen to a raging torrent of muddy water. The fish knew that this was coming and had expressed their joy the previous evening in anticipation of either a good feed coming down with the rush, or of the opportunity of going up stream. The fisherman immediately saw the prospects, nevertheless he made a few casts in despair, lost a 'spoon', and together we returned to the Bungalow full of regrets. So on to Belgaum.

Business detained us at Belgaum for a day and a half. Nevertheless when opportunity arose we drove to the nearest jungles or investigated the bird life around the old fort. Rain had been heavy in this area. The vegetation in the deciduous forests was reviving. The botanist was in his element, several terrestrial orchids pushed their 'flowery heads' above the soil. The fisherman had forsaken his rods and turned his attention to ornithology. Birds were numerous. The occasional conversation was highly spiced with Latin and Greek. The terminology was often as unintelligible to one another as Chinese to the Bushman—but what of that? It was scientific, and one was glad to con a new name from the other. In this forest under piles of boulders we saw an earthen nest adhering to an under face. It looked like the nest of a swallow. On getting up to it we found the entrance plugged with freshly gathered material, but no sign of life. The botanist stuck his knife into it and we were never more surprised than to see a whole family of Tree mice (*Vandeluria*) jump out and run away as fast as they could go. There were father, mother and several children. In their haste they used our bodies as a short cut to the ground and in our haste we lost all, bar one.

On the 8th afternoon we left Belgaum with no regrets and continued our way southward. That night we spent in an uninteresting Dak Bungalow at Hubli and were early on our way next morning continuing our journey towards Gersoppa. Rain had been heavy during the night and in places the roads were like soft chocolate. The P. W. D. had taken this opportunity of repairing and building culverts and bridges and had made several divisions which often made us extremely anxious of the present and very anxious about the future. At times the car behaved like a camel in distress on slush. Only those who have had the pleasure of being astride a camel under such conditions will appreciate the simile perfectly.

The further south we went the more it rained, until in the dense forests it became a deluge the whole duration of our stay. As far as Siddapur the road was alright, but after that there were streams to cross. En route the deciduous forests were carpeted with an handsome yellow and white *Curcuma*—a member of the Canna family. In some places, giant millepedes (*Julus*) streamed about like miniature trains. Some were added to the collection. A curious point about these creatures is that they emit a strong odour of bromine and frequently stain the hands pink. At one point the car was brought to a halt by the excited shouts of the botanist to stop—he had seen something. It was one of the most beautiful of the ground orchids. It was a *Eulophia* with large bright golden yellow flowers (*E. campestris*). The colour of the flower of this species has given rise to many different statements. Having secured the prize we moved on. The conversation now turned to orchids and a sharp look out was kept for further specimens with no result. We sped merrily on till we were descending a slope, when excited shouts again brought the car to a halt. The botanist had espied a green Tick (*Trimeresurus annamalensis*) reposing on the roadside. It was soon safely stored away in a bag next to the driver, who henceforth betrayed a certain uneasiness. The operation of catching this brute had been observed by two or three locals who immediately opened fire in good Kanarese. It fell on deaf ears, as neither of us understood that language, not that it mattered, it was easy to conclude what they meant by their excited ejaculations, for when the viper was safely in the bag, their arguments stopped and they looked at us dumbfounded and probably concluded that we were either satanic or insane. What a story they must have told when they got home? The length of the snake must, by this time, be several yards. Leaving these good folks to their story we moved on.

On the 9th afternoon we arrived at Gersoppa Bungalow to find it enveloped in driving heavy rain clouds, and from now on it remained rain and clouds. Now and again there was a break in the clouds and we got a glimpse of the falls and the roar of the rushing water intensified. Rain or no rain, we ventured out—we were out for specimens. At night we sat round our lantern in the hope of insects, but few ever came and most of these were microscopic. At intervals we made a round of the house for lizards and to our good luck secured specimens of a newly described gecko (*Hemidactylus prashadi*) and a rare frog, *Rana leithii.*

The next afternoon we went down to the falls themselves, as it promised to be clear for a time. The rain had stopped, but the clouds still swept up the gorge. The angler decided to try the river above the falls but after several attempts gave it up. The botanist who had visited the falls in October nearly twenty years ago promised the fishing-ornithologist a sight to be remembered—'millions of swifts and Blue Rock Pigeons'. Such was the sight he had witnessed on his previous visit. To his dismay and the disappointment of the angler there were *no* swifts (*Micropus m. melba*), (we saw one which seemed doubtfully of this species away down in the cauldron) and but a few Blue Rock Pigeons. Perhaps the fisherman was by this time making mental reservations, but the word of the botanist is supported by—the *Fauna.* Here we find 'I have repeatedly had reports as to its breeding at Gersoppa Falls'—but no proof. Here again is a problem for the ornithologist. June is the breeding month of this swift. Accordingly we should find them in large numbers round the falls—if they breed there—but this was not the case, so they must be breeding elsewhere, indicating a local migration during certain seasons. We carefully examined the cliffs with powerful binoculars, but there were no traces of nests as far as we could see. In the Pulnai Hills, the botanist had shot them in the months of June and July, but as this bird flies at an enormous speed, this is no evidence to show that they live in that habitat during these months —the breeding months. What is it then that attracts them to the Falls in October? They definitely roost there at that time.

The same problem arises in the case of the pigeons. Where do the greater majority go during the rains if there are so many during October. In October both the swifts and the pigeons left the cauldron of the falls by the thousand every morning, and generally returned about three or four in the afternoon when the mists began to gather. The air vibrated with their shrill calls. In both cases there is a definite migration. Here we must leave the subject until further light is cast on it.

Weather conditions became worse, so we decided to return next day. Our collection was small but interesting. We had not gone far beyond the village of Jog, when we found our anxiety about the return journey fully justified. The streams were considerably swollen and the sticky bits had become stickier. The car crawled out of one bit with its wheels driving yards of slush behind, but the worst was to come. We had not gone many miles when we came to a stream—it was deep and rushing, but it had to be negotiated if we were to get home this monsoon. On the far side was a considerable length of liquid 'chocolate' sprinkled with branches and stones which sank of their own weight. Hurrying lorries had ploughed this mess into a dangerous quagmire and a sure trap for cars of low clearance. We got out and allowed the driver to use his judgement. All went well till the car got a little beyond the middle of the stream with water half way up the radiator, then it stopped. Our spirits sank lower and lower while the water rose higher and higher inside the car till all was afloat. The engine had stopped and refused to start. All luggage, plus its water contents was unloaded. A little later a foot on the starter, and the engine responded to our great joy—it had stopped for a breather! Good fortune was on our side—the car just managed to clear the water only to stick in the semiliquid mess. It was nearly four hours before we were able to extricate ourselves with the aid of locals and the principle of levers.

While we were embedded, we held up all traffic. A lorry arrived on one side followed soon after by another car containing a possible military officer. It was once said of a soldier 'he came, he saw, he conquered', but of *this* soldier it must be said: 'he came, he saw, he fled'—like a scalded cat. The fat lorry driver had the heart of a worm—he refused to attempt to tow us out. The only assistance he offered us was by way of sitting on the bank and staring at our efforts like a thinking sheep. Once on the road again, we found all was well with the car. Only a Ford could have got through without protesting, so much we must say for the engine, but Oh, the springing, it strained our nerves to breaking. As it often happens in difficulties, more trouble is added to the existing ones. All through our efforts to extricate the car it rained heaven's hardest from time to time. Now that we were out, even Nature rejoiced, the rain held off and the sun made heroic efforts to peer through the blanket of clouds. We were covered with mud and this had to be got rid of—quite an easy matter—there was the stream. So we 'dhobied' ourselves in it and got into cleaner though not much drier clothes.

By this time we had had enough, so we headed for home as fast as we could go only to stop the night at Satara and then move on. At Satara we dined at the 'Hotel de Luxe' and were calmly told after dinner that there was no sleeping accommodation, but the keeper, a portly gentleman, with a distinct sag under the belt, told us that he could accommodate us in a bungalow some distance away. To this we were conducted. There were beds but no mattresses—the least of the difficulties—and no conveniences. On comparing notes for the night, we agreed, that we had slept badly—the creaking of wire springs and screaming mosquitoes. The Deccan by this time was of a different picture—green had replaced the kahki—dry rivers were now rolling currents of thick pea soup. At Satara we shipped an extra load by way of a ponderous soldier-botanist whose car had let him down—his is a sad story. On reaching the Khandala Ghats (Satara District) we decided to walk down. Those that were botanically minded knew the Ghat to be the home of *Caralluma fimbriata* and *Kalanchoe olivacea.* The Katraj Ghat was the next objective. Having surveyed this Ghat, Poona was a short run. Here we unloaded the extra 15 stone, and turned our noses homewards without any further adventures.

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